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ANNALS of SURGERY

A Monthly Review of Surgical Science and Practice

Edited by LEWIS STEPHEN PILCHER, M.D., LL.D., of New York

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OF

SURGERY

A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

EDITED BY

LEWIS STEPHEN PILCHER, M.D., LL.D.,

OF NEW YORK

WITH THE ASSOCIATION OF

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SURGERY OF THE PITUITARY LESION *

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OF PHILADELPHIA, PA.

FROM THE NEUROSURGICAL CLINIC OF THE HOSPITAL OF THE UNIVERSITY OF PENNSYLVANIA

THE surgery of pituitary lesions has grown during the past fifteen years from a problem of minor to one of major importance. The first operation upon the pituitary body in our neurosurgical clinic was performed in 1912, and today pituitary lesions represent 15 per cent. of our register of intracranial tumors. The surgical problems here involved differ in many respects from those of tumors of the cerebral or cerebellar hemispheres. In the latter we may be dealing with tumors within or without the brain mass, tumors cortical or subcortical, tumors encapsulated or non-encapsulated, tumors often difficult of localization, many of them inoperable, tumors in most instances associated with a high degree of intracranial pressure, tumors often of large dimensions, tumors for the most part malignant.

Contrast these physical factors with the pituitary lesion. The diagnosis in most instances is apparent, the location constant, the lesion entirely extracerebral, the pathology in the majority of instances benign, the size rarely of dimensions larger than the English walnut, often without any increase in intracranial pressure. The surgery of pituitary lesions differs from that of the brain tumor generally in that the primary purpose in the former is to save vision and in the latter to save life. The intimate relation of the pituitary lesion to the optic chiasm and optic nerves is an ever constant factor and one peculiar to the pituitary as contrasted with the brain tumor.

Another distinguishing feature in these two fields of intracranial surgery is that there are for the pituitary lesion two avenues of approach, namely, the transphenoidal and the transfrontal. In this clinic we have wavered at different periods between one and the other, but for the past three years have abandoned the transphenoidal route. Although realizing with the latter a lower operative hazard, we were however forced to recognize its limitations since recurrences of symptoms were not infrequent. By the transphenoidal route at most one can evacuate the contents whether liquid or solid, but the capsule remains undisturbed. Were the capsule always collapsible, so that when the contents were removed, the capsule collapsed, pressure on the optic chiasm and nerves would be released and the object of the operation accomplished.

* Read before the joint meeting of the New York Surgical Society and the Philadelphia Academy of Surgery, February 8, 1928.

But in many instances the capsule is so firm and unyielding that its relation to the overlying structure remains undisturbed and the effects of pressure upon the optic chiasm are not relieved, or if relieved, may soon recur. This is not a conjectural hypothesis, but has been demonstrated at the operating table in transfrontal operations performed on patients in whom previously the transphenoidal approach had been employed.

The facility or the difficulty with which the pituitary lesion may be dealt by the transfrontal approach depends upon two factors, the size of the lesion and its position with relation to the chiasm. In the normal subject there are two recognized relationships between the pituitary body and the chiasm, the pre- and the post-chiasmal. Obviously a pituitary lesion in the post-chiasmal location, extending some distance behind the chiasm and beneath the third ventricle, offers greater difficulties in exposure and removal.

The flap for the transfrontal exploration may be fashioned in several ways. In this clinic we have employed two methods. In all cases the flap is reflected toward the temporal fossa, in most one incision passes along the line of the eyebrow. In acromegalic subjects, in whom invariably the frontal sinuses are unusually large, we select a crease about the middle of the head as the line for the lower incision, on the grounds that in opening the frontal sinus one must reckon with a potential source of infection. While in most of our intracranial explorations local anæsthesia is preferred to ether inhalation, local anæsthesia seems more specifically indicated in the pituitary operation.

With the objective situated at the base of the brain, access is obtained only by elevation of the overlying brain mass, and this can be accomplished only when there is a minimum of intracranial pressure. There isn't the slightest doubt in our minds, as frequently demonstrated, when in the midst of an operation begun under local anæsthesia for some reason resort had to be had to ether, that intracranial pressure is greater under the effects of ether anæsthesia. When there is an associated hydrocephalus, evacuation of the ventricles becomes an imperative necessity; under no other circumstances can the lesion be exposed.

There is only one feature of this operation that at any time has given us concern. In a few instances at the conclusion of the operation there has been an unexpected and unexplained fall in blood pressure. Assume the operation to have been performed under local anæsthesia, the lesion to have been readily exposed and removed, with the loss of but an insignificant quantity of blood, the systolic blood pressure drops to 60 or thereabouts The appearance of the patient would not excite alarm, the pulse may be accelerated, but the surface temperature of the extremities is warm, the kin dry, respirations not embarrassed, the patient conscious and quiet. Appropriate remedies, pituitrin, adrenalin and ephedrin are given hypodermatically, but without more than momentary effect. Any and every attempt to raise the blood pressure fails and after 24 or 36 hours conditions grow from bad to worse and collapse follows. We have been at a loss to satisfactorily explain this phe-

nomenon, but by observation have the impression that when the lesion is approached from an angle, as along the greater wing of the sphenoid, rather than from directly in front, when the blade of the retractor does not press upon the structures directly overlying the pituitary region, but to one side, this blood pressure break down has not occurred. Hence in this lateral approach the portion of the lesion on the side opposite that of our flap is not so accessible. However, when we are confronted with a lesion of large dimensions, especially in its lateral rather than its antero-posterior dimension, the propriety of dividing the operation into two stages becomes apparent. We therefore venture to suggest the propriety of a bilateral approach, as in following case.

Summary.—A young woman in her teens having for six years paroxysmal headaches, vertigo, visual hallucinations, epigastric pains and later visual defects, has an exceptionally large pituitary adenoma. To deal adequately with the lesion the operation is divided into stages, with an interval of three months. At the first the right portion of the tumor is removed, at the second the left. Both operations are well tolerated and the patient recovers with normal fields.

Female, aet. seventeen years, File No. 11339, was referred to the Neurosurgical Clinic of the University Hospital, January 26, 1927, through Doctor Baer of the Wills Eye Hospital.

Previous Illnesses.—As a child she had measles, chicken pox, diphtheria and whooping cough. Later typhoid fever and influenza (1918).

Family History.—There is no record of any endocrine disturbance in the family. Father was killed in an accident, mother, three brothers and three sisters living and well, two sisters died from tuberculosis.

History of Present Illness.—The patient was quite well until 1921, six years ago, when she began to have severe *headaches*, throbbing in character and referred to the supraorbital region. These headaches at first lasted a few hours or for a day and then passed off, often associated with *nausea* and *vomiting*. *Tinnitus aurium*, right, often appeared after the headache subsided and persisted for a while. Two months before the headaches began she had a curious attack in which she thought she saw pictures of people appearing and disappearing on the wall (*visual hallucinations*). She heard no voices. These hallucinations lasted for a day or two and then vanished. She never saw bright light or scintillating scotomata. During the succeeding year the headaches recurred from time to time and were worse on stooping.

January, 1926, her vision began to fail as the patient said a film seemed to be growing over the eye from the temporal side. She noticed especially at night, as she lay in bed, that each night she could see less and less in the temporal fields.

As time went on she complained of a sense of weakness in the knees and later of *cramps* especially in the epigastric region. These pains were not related to the ingestion of food; at one time she had an attack of *transitory blindness*. All the while her headaches were continued with varying severity, mostly throbbing and frontal. Vomiting was occasional. At times she complained of vertigo; objects appeared to be turning around from left to right. Meanwhile her vision was becoming more and more impaired until she had another attack of transitory blindness on this occasion in the left eye. *Menstrual History.* Periods began in sixteenth year, two periods each month, excessive and painful. Arrest of menses April, 1927.

Physical Examination.—Head. Nothing abnormal about ears, nose, mouth or features. *Neck.* There is a palpable and symmetrically enlarged thyroid gland. *Thorax.*

The breasts are large for her age and recently have grown considerably in size. The lungs and heart present no abnormal signs. Blood pressure 106–54. *Extremities.* The hands and feet seem disproportionately large for her age and race (colored). *Neurological Examination.* The reflexes are normal, there is no motor or sensory dysfunction; there is, however, impairment of sense of smell (left) and a right horizontal nystagmus.

Pituitary Phenomena.—X-ray. Pituitary fossa 22 mm. by 16 mm. Beginning atrophy of the dorsum sella. *Basal metabolism* minus 20 per cent. *Pressure.* Frontal headache. Pressure of cerebrospinal fluid 19 mm. Hg.

Endocrine.—Enlarged hands and feet. Smooth shiny skin. Enlarged breasts. Accession of weight ten pounds. Amenorrhœa. Enlarged thyroid gland.

Ophthalmic.—Bitemporal hemianopsia. There is pallor of both discs, especially on the nasal sides and more so of the left disc, with a yellow waxy appearance. Vision; O. D. 6/6 O. S. 6/12. There is a crossed diplopia and some divergence.

First Operation.—July 1, 1927. Transfrontal craniotomy. The flap was reflected from the right side, the lower margin of the flap about the middle of the forehead, rather than in the eyebrow. There was considerable dural tension, but this was found to be largely due to a collection of fluid in the subarachnoid space so that when the dura was opened and the fluid escaped in considerable quantity, the pressure subsided.

Our usual technic was followed, elevating the frontal lobe and following the direction of the greater wing of the sphenoid. The right optic nerve was soon reached, much farther out than in the average case. The lesion was exposed and found to be a cyst adenoma. About a half of a hypodermic syringe full of bloody fluid was evacuated. The cyst wall was then penetrated and found to be lined with a layer of glandular tissue. As much of the wall as presented on the superior surface and on the lateral surface was removed, that is, on the right side. No attempt was made to deal with the lesion on the left side. Tampons saturated with adrenalin were applied to the cavity for a few moments before the final closure of the wound, at which time hemostasis was complete. Wound closure without drainage. During the operation the blood pressure and pulse rate remained practically unchanged. The pulse rate was lower at the close than at the beginning of the operation. *Immediate Result:* Operative recovery. *Discharge* from the hospital, July 11, 1927.

In this case it was decided to remove the tumor in two stages, confining our efforts at the first stage to the left side and reserving the removal of the right side to the second stage. Since her discharge the patient has been free of symptoms. Her menses returned in September for the first time since April. The patient observes that she drinks more water than prior to the operation, 14 to 16 glasses a day (polydipsia).

Readmission.—The patient states her vision has improved and the fields show definite retraction of the temporal fields, more marked on the right than on the left (see Chart). The cerebrospinal pressure is now 10 mm. Hg. as compared with 19 mm. Hg. before the first operation.

Second Operation.—October 3, 1927. Transfrontal craniotomy, left. Local anæsthesia. Closure under ether. The flap was reflected from the left frontal area precisely corresponding to that of the first operation on the right—that is, a high frontal flap with the incision about the middle of the forehead. The dura was moderately tense as before and there was considerable fluid in the subarachnoid space.

The frontal lobe was carefully elevated until the olfactory nerve was seen, and then the optic nerve and to the inner side of the optic nerve the bluish wall of the tumor. A needle was introduced but no fluid was withdrawn.

An incision was made with a capsular knife and as much of the wall as presented was removed with a pituitary punch, so that the left optic nerve and the corresponding half of the chiasm was entirely free of pressure.

There was practically no bleeding although a small muscle graft was placed in the raw bed of the adenoma as a guard against oozing, and the wound closed without drainage.

Comment.—Particularly impressive today was the uniform pulse and blood pressure

which continued at 120 throughout the operation and the pulse usually between 80 and 90. *Immediate Result:* Operative Recovery. *Pathological Diagnosis:* Pituitary adenoma (basophilic).

The patient's convalescence was uneventful and she was discharged from the hospital October 14th, eleven days after the operation. Her vision at this time was O. S. 6/6 and O. D. 6/12. There was no obscuration of the temporal fields.

One naturally hesitates to propose a two-stage procedure when one stage will suffice, but the suggestion is made chiefly as a measure of safety and would seem to be justified by our experience in pituitary surgery. But while the primary exposure of the lesion is accomplished without hazard or difficulty, the subsequent steps of the procedure, that is the removal of the lesion, might be said to be a ticklish performance. The steps incidental to the removal of an endothelioma may be tedious, but the tumor is usually readily accessible, especially those sagitally situated, and little harm is affected by displacement of the cerebral mass surrounding the tumor. Even the exposure and removal by suction of a degenerating glioma or the resection of a gliomatous cyst is attended with minor difficulties and little hazard.

But with pituitary lesions one must proceed gingerly. In the first place there is, as already mentioned, the harmful effect of retractor pressure. Then one must be especially careful not to make undue traction on the capsule. It would seem a simple thing after the capsule has been freed on its lateral and anterior aspects to dislodge and extract the capsule in toto by moderate traction. But such an attempt has been found to be a hazardous procedure. Here again one may see an alarming fall in blood pressure. One must be content patiently, with special punches and scissors, to resect the capsule piecemeal. Every step in this process must be executed with great delicacy, with a minimum of force. It is because, therefore, of these attending risks that additional precautions must be observed and only by so doing can one keep the operative mortality reasonably low. In our recent series of eleven transfrontal craniotomies there was one fatality. We have not yet reduced the mortality below 3.5 per cent. in a series of thirty-five consecutive transphenoidal operations. But the inadequacy of the procedure, while free of risk, has a larger percentage of recurrences so that for the present at least we feel obliged to adopt the transfrontal method as the procedure of choice. And in tumors of large dimensions we employ the dual approach as recommended in this paper.

POST-OPERATIVE PULMONARY ATELECTASIS *

By Walter Estell Lee, M.D., Gabriel Tucker, M.D.
and
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Our continued interest in the subject of post-operative pulmonary atelectasis has served to convince us more firmly in the probability of the statement made in our first report (Annals of Surgery, April, 1924, p. 506), "that the phenomena of pulmonary collapse of varying degrees, together with pulmonary embolism and infarction, are the real etiological factors in post-operative pulmonary complications." We agree with Mastics in his recent estimate that over 70 per cent. of the so-called post-operative and post-anæsthetic pneumonias are varying degrees of atelectasis. We again state our belief that in the small proportion of true pneumonias developing post-operatively, all start as varying degrees of atelectasis, and upon these lesions are engrafted infarction and infection. *Massive atelectasis*, involving more than one lobe of the lung, is usually mistaken for pleural effusion, empyema or pneu-

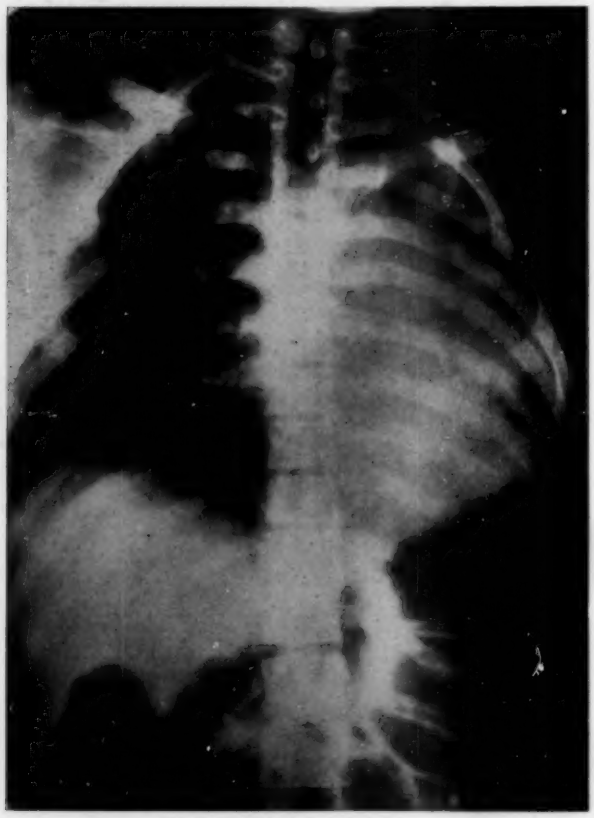

Fig. 1.—C. M., male, white, fifteen years. Pennsylvania Hospital. Forty-two hours after radical right inguinal herniorrhaphy, massive atelectasis left lung.

* A demonstration by motion pictures of the clinical phenomena of post-operative atelectasis and bronchoscopic removal of obstructing bronchial secretion, before the combined meeting of the Philadelphia and New York Academies of Surgery held February 8, 1928.

mothorax. *Lobar atelectasis,* involving but one lobe, is diagnosed lobar pneumonia. *Lobular atelectasis,* involving scattered areas in one or more lobes, receives the diagnosis of bronchopneumonia or pulmonary infarction. The fact that atelectasis has been recognized as a congenital lesion; occurring spontaneously; in bronchial and pulmonary infections; in nonpenetrating wounds of the thorax, abdomen and lower extremities; in increased abdominal pressure, associated with tumors, intestinal distention and peritoneal effusion; in postures immobilizing the thorax and abdomen; in nasal and pharyngeal diphtheria; in foreign bodies in the trachea or bronchi; and following operations upon the abdominal wall, intra-abdominal organs, genitalia and lower extremities, indicates that more than one etiological factor may be involved. In the thirty-three cases of post-operative massive atelectasis whose records we have been able to study we are persuaded that two factors have been constant in this group: first, a thick *vicid bronchial secretion,* and, second, some *inhibition of coughing.* Because of the thick, tenacious character of this bronchial secretion and the inability, or disinclination, of the patient to clear it from the bronchi, it accumulates in the dependent portions of the bronchial tree until at some point or points this stream of mucous completely occludes the lumen. If this occlusion takes place in a small bronchiole, we will have *lobular atelectasis;* if it occurs in a bronchus leading to one lobe, we have *lobar atelectasis;* and if it occurs in a main bronchus of either lung, we will have *massive atelectasis.*

FIG. 2.—C. M., male, white, fifteen years. Pennsylvania Hospital. Röntgen-ray taken fourteen hours after bronchoscopic drainage of the obstructing secretion from left main bronchus.

The mechanism by which such an obstruction may be produced has been recently suggested to us by the experimental work of Archibald, reported before the Association of Thoracic Surgeons at the New York meeting in 1927, upon The Dangers of Cough (*Arch. of Surg.,* vol. xvi, Part 2, No. 1, January, 1928, p. 322). The question was raised by Archibald that if the bronchial secretions are not entirely expelled by the expiratory effort, they might be

drawn further into the bronchial tree by the following inspiratory rush of air. He found that substances of a consistency of mineral oil were drawn further into and probably reached the terminal alveoli of the lungs after a number of coughing spells stimulated by mechanical irritation of the pharynx, while substances of greater consistency and viscosity, such as mucus and sputum, were expelled by the first expiratory effort and cleared from the bronchial tree and were rarely drawn further into the bronchi. It is conceivable that when the viscosity of the bronchial secretion is not sufficient to insure its complete expulsion by the expiratory cough, nor sufficiently fluid to be drawn into the terminal bronchioles, it will move backward and forward at expiration and inspiration and definite waves will be created upon its surface. There is one point, of course, where the expiratory and the inspiratory wave meet and here a form of tidal bore may be created which can be compared to the wave produced by the meeting of tides in a narrow bay. This suggests to us an explanation of the piling up of the stream of vicid bronchial secretion into waves, one or more of which finally reach the opposite wall of the bronchus and because of its viscosity, sticks and completely occludes the lumen of the tube. With recurring coughing and marked inspiratory efforts this mass of secretion is drawn further into the bronchus and complete obstruction is maintained.

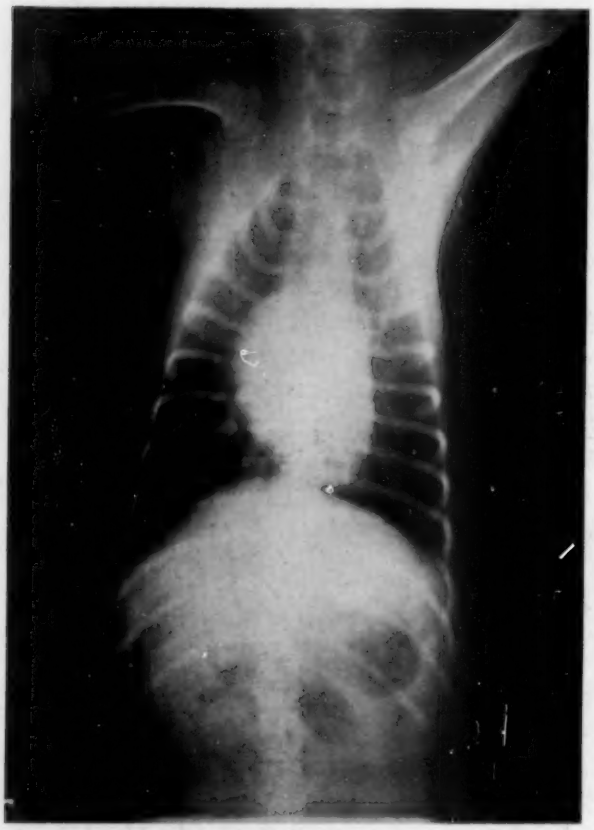

FIG. 3.—Dog 456. Laboratory of Surgical Research, University of Pennsylvania, Philadelphia. Röntgen-ray taken by Doctor Pendergrass, twenty-four hours before the exploratory laparotomy and experimental production of massive post-operative pulmonary atelectasis of right lung.

Clinically we have demonstrated that if this obstruction can be overcome by making the patient cough, by a change of position, as suggested by Santee, by vigorous shaking, and in young children, by actual spanking, and an airway be established past this point or points of obstruction, the patient may, temporarily at least, free the bronchial tree of large masses of secretion and thus

reinflate the pulmonary tissues. In eight cases we have found it necessary deliberately to aspirate through a bronchoscope the obstructing portion of this bronchial secretion, and in each case immediate aeration and reinflation of the pulmonary tissue distal to the point of obstruction has followed.

The similarity of the atelectasis found by Chevalier Jackson in foreign body obstruction of the bronchi to that of post-operative massive atelectasis was discussed with Jackson by Leopold and Lee in 1923. Leopold suggested a condition of drowned lung to account for the density of the Röntgen-ray shadow found in post-operative massive atelectasis. Drowned lung was described by Johnson as an accumulation of a fluid exudate in the bronchi and air vesicles distal to the partially obstructing foreign body. The air enters and leaves until such a time as the vesicles become filled with exudate. In such a lesion there would be no actual decrease in the size of the lung, no true atelectasis, and, therefore, no displacement of the heart such as we find in the classic picture of massive atelectasis.

FIG. 4.—Dog 456. Laboratory of Surgical Research, University of Pennsylvania, Philadelphia. Röntgen-ray taken by Doctor Pendergrass, twenty-four hours before the exploratory laparotomy and experimental production of massive pulmonary atelectasis of right lung—normal.

Recently at the Pennsylvania Hospital we have had presented an unusual opportunity in a case of massive post-operative pulmonary atelectasis of the left lung following a radical right inguinal herniorrhaphy under ether anæsthesia. During the administration of the anæsthetic there was more mucus in the respiratory tract than usual, an observation which is very common in this group we have studied. About twenty-four hours after the operation breath-

ing became peculiarly distressing. It was quite evident that it was voluntarily restrained because of the pain in the operative wound. The temperature began to rise and there was a slight midsternal pain. Forty-two hours post-operatively, the respiratory distress was more marked, and the cough was short, shallow and but slightly productive of a tenacious sputum. At this time there was distinct displacement of the heart to the left of its normal position, and the clinical diagnosis of massive atelectasis of Doctor White was confirmed by Röntgen-ray examination by Doctor Bishop. Ten hours after the onset of these clinical symptoms and three hours after its confirmation by Doctor Bishop, Doctor Clerf drained through a bronchoscope from the left main bronchus 9 c.c. of the usual characteristic, thick, tenacious bronchial secretion. Bacteriologic examination of this secretion gave a pure culture of pneumococcus. There was immediate relief following this bronchoscopic drainage, more complete and satisfactory than in any of the previous cases in which this had been attempted. The fact that in the other cases forty-eight hours was the shortest interval between the onset of the symptoms and the bronchoscopic drainage was the explanation we gave for the more satisfactory results at this time. (See protocol No. 2 of Doctor Clerf.) This specimen of bronchial secretion was kept upon the ice for the next twenty-four hours until it was possible to provide the setting for its introduction into the main bronchus of a dog. In order

FIG. 5.—Dog 456. Laboratory of Surgical Research, University of Pennsylvania, Philadelphia. Röntgen-ray by Doctor Pendergrass, three hours after exploratory laparotomy and the bronchoscopic introduction of 7 c.c. of the obstructing secretion removed by Doctor Clerf from the left main bronchus of the patient, C. M. (Fig. 1) with massive post-operative atelectasis.

that all of the suspected etiological factors be provided, the dog was first narcotized with morphia, etherized, and then an operative incision was made through the upper half of the right rectus muscle, entering the abdominal cavity. This wound was closed by continuous layer sutures of silk and then strapped with broad adhesive plaster which encircled the lower portion of the costal arches, as we dress so many of our upper abdominal wounds. The dog was then laid upon his right side and after cocainizing the nasopharynx the bronchoscope was introduced into the main bronchus of the right lung and 7 c.c. of the secretion previously removed from the left main bronchus of the patient was introduced into the right main bronchus of the dog. At first there was definite coughing and struggling, which fortunately resulted in the drawing of the secretion into the deeper portions of the bronchial tree. At this point Doctor Ravdin introduced intraperitoneally 250 mgm. of sodium amytal, with the object of producing a deep narcosis and eliminating the cough reflex. This was promptly followed by a deepening narcosis and the disappearance of the cough reflex. With the loss of the cough reflex, respiratory efforts became deeper and the entire mass of bronchial secretion was drawn into the right bronchus. A few minutes after the completion of the introduction of the bronchial secretion and following the removal of the bronchoscope, definite respiratory distress developed. This distress was so marked that it seemed for a time that the dog was about to die. The respiratory movements finally became regular and rhythmic and before the dog was placed in the kennel Doctor Ravdin said that the movements of the right side of the chest were almost lost, while those of the left side were very much exaggerated, and there was distinct bulging and a visible increase in the size

FIG. 6.—Dog No. 456. Laboratory of Surgical Research, University of Pennsylvania, Philadelphia. Röntgen-ray taken by Doctor Pendergrass three hours after exploratory laparotomy and the bronchoscopic introduction of 7 c.c. of the obstructing secretion removed by Doctor Clerf from the left main bronchus of the patient C. M., (Fig. 1) with massive post-operative atelectasis.

of the left half of the thoracic cavity. The dog was kept on his right side for three hours, at the end of which time a Röntgen-ray examination made by Doctor Pendergrass at the University Hospital showed that there was complete atelectasis of all lobes of the right lung with transposition of the heart to the right beyond the spine. (See protocol No. 4 of Doctor Pendergrass.)

Although various substances have been tried to produce experimentally pulmonary atelectasis, as far as we know this is the first successful attempt in which the obstructing bronchial secretion from a clinical case of post-operative massive atelectasis has been used to produce it in an animal. We feel that this opens a field of experimental research which will make it possible to evaluate the various etiological factors which have been suggested.

PROTOCOL No. 1.—Abstract of history of Doctor St. Claire, Pennsylvania Hospital. Cosmo Manelli, male, white, single, fifteen years of age. Pennsylvania Hospital.

January 7, 1928.—The patient was operated upon by Doctor Lee at about 2 P.M. today and a radical herniorrhaphy performed upon a right inguinal hernia. During the operation there was more mucus in the respiratory tract than usual and by the following afternoon, twenty-four hours later, there was a definite cough, which, however, was restrained because of the resulting pain in his operative wound. There was a slight rise in temperature at this time.

January 8, 1928.—The patient complained this evening about 11 P.M. of severe midsternal pain and some discomfort in his chest. He would put his hand over the left side of his præcordia and point to it as the site of his discomfort.

January 9, 1928, at 8 A.M., approximately forty-two hours after the operation, his distress was more apparent and his cough short, embarrassed, frequent, and but slightly productive of a tenacious sputum. He complained of pain in his left axillary region which extended to his præcordia with each attempt at coughing. The fever has risen slowly and steadily during the night and his sleep was definitely interfered with. One dose of elixir terpene hydrate with ¼ grain of codeine sulphate was his only medication. At the time of this examination, 8 A.M., there was distinct displacement of the heart to the left. This was between 2 and 3 cm. to the left of its normal position. There was hyperresonance in the left anterior chest which blended with gastric tympany. Posteriorly the findings are those of consolidation. There was some impairment, distant tubular breathing over the lower half of the left chest and posterior to the posterior axillary line. By noon of this day the apex was felt in the fourth interspace behind the fold of the left pectoralis major muscle. The whole anterior portion of the left chest was hyperresonant above this point and merged into the gastric tympany below. Posteriorly the whole left chest posterior to the posterior axillary line was impaired to percussion and there was distinct tubular breathing and egophony. The short, painful cough was increased and restlessness was very apparent at this time. There was a look of anxiety accompanying the restlessness. Cyanosis gradually appeared during the morning and by noon it was quite evident in the lips, ears and under the finger nails. At noon the contrast between the freely moving right chest and the comparatively fixed left chest was striking. At 2 P.M. the right border of the heart to percussion was to the left of the left border of the sternum (the compensating right lung was probably encroaching sufficiently to give a false right cardiac border). At this time Röntgen-ray examination was made. The fluoroscopic examination showed the typical picture of massive atelectasis of the left lung. The whole left chest was dark, in contrast to the right chest. The right diaphragm moved freely and with greater excursion than normal. It was impossible to recognize the dome of the left diaphragm because of the density of the shadows. Displacement of the heart was sufficient to place the right border beneath the sternum. On deep inspiration the heart displacement was increased toward

the left side, so much so that the right border was distinctly to the left of the left border of the sternum. This was for a distance of a few millimetres. An X-ray picture taken at this time was interpreted by Doctor Bowen as follows:

"X-ray No. 62537, Chest: Rather typical collapse of the left lung. There is, however, less displacement of the heart toward the left than we usually expect. There is practically no displacement of the trachea to the left. The lateral movement of the heart with respiration is sufficient to warrant the diagnosis. Presumably, the lack of displacement is due to a rather unusual amount of fluid in the collapsed lung."

Protocol No. 2.—Doctor Clerf. January 9, 1928, 5:45 P.M., Pennsylvania.

A dose of morphia, gr. ¼, and atropine, gr. 1/150, were given hypodermically and preparations made for bronchoscopy.

With the patient on the operating table a moving picture was started to show the patient's efforts to expel the obstructing bronchial secretion. This moving picture was continued during the bronchoscopic drainage.

Doctor Clerf's report of the bronchoscopic drainage is as follows:

"A large quantity of thick, tenacious mucoid secretion was coughed up through the bronchoscope as soon as it was introduced into the trachea; the left main bronchus seemed completely filled with secretion. In all 9 c.c. were aspirated and collected in a Lukens tube. The mucosa of the trachea, the orifice of the right main bronchus and the left bronchus with its subdivisions were inflamed. The lumen of the left bronchus seemed practically normal in size. Because of the continuous coughing efforts of the patient, it was difficult to make any observations regarding bronchial movements.

Bronchoscopic diagnosis: Acute tracheobronchitis. Plugging of left bronchus and subdivisions with thick, tenacious secretion. Secretion aspirated.

Remarks: The 9 c.c. of secretion collected does not represent the total quantity. Approximately three c.c. were coughed up through the bronchoscope and several additional c.c. were coughed up into the pharynx at the time of the laryngoscopy. The character of the secretion differs somewhat from that usually observed in these cases. It is grayish in color and contains many tiny air bubbles. As observed by Doctor Lee, this is probably due to the fact that bronchoscopy was performed very shortly after the onset of the collapse, approximately ten hours."

Surgeons: Dr. Louis Clerg, Doctors Lunn and St. Claire.

In addition to the secretion which was obtained directly through the bronchoscope the moving picture shows very clearly the coughing up of several mouthfuls of this same vicid secretion after the bronchoscope was removed. In other words, after the bronchoscope had established an airway beyond the point or points of obstruction, the patient himself was able to clear the obstructed bronchial tree by his own voluntary efforts at coughing far more thoroughly than we were able to aspirate the material through the bronchoscope. The bronchoscope was of peculiar value in overcoming the obstruction and establishing the airway, but it was the patient's own efforts which were most productive in clearing the bronchial tree of its secretion.

Protocol No. 3.—Dr. Gabriel Tucker. January 11, 1928, Dog No. 456.

Bronchoscope was introduced by the Jackson technic, local anæsthesia used, 4 per cent. cocaine to the larynx. The mucosa of the tracheobronchial tree was normal. There was no abnormal secretion. Secretion provided from the lung of a patient with massive collapse (Cosmo Manelli) (by Doctor Lee and Doctor Clerf) was introduced into the right main bronchus, and the larger bronchial subdivisions were filled with the secretion as high in the tracheobronchial tree as the carina. With inspiration no lumen appeared past the secretion, showing that it was completely obstructed. The preliminary morphine narcosis and ether anæsthesia was reënforced by the intraperitoneal injection of sodium amytal. This completely abolished the cough reflex. Before the bronchoscope was withdrawn the cough reflex could no longer be excited by intrabronchial manipulation. Careful inspection was made to insure that the secretion was placed only in the right lung.

Bronchoscopic Finding.—Mucosa of the tracheobronchial tree normal. Complete occlusion of the right main bronchus and its branches by bronchial secretion provided by Doctor Lee and Doctor Clerf from a patient with massive atelectasis.

Protocol No. 4.—Doctor Pendergrass. January 12, 1928, Dog No. 456.

Control Films: Heart is in the midline. Both lungs aerated normally. No increased densities were seen.

Three hours after insufflation of material into the right bronchus: There is almost a complete atelectasis of the entire right lung, especially the right upper lobe and to a less extent the right lower lobe. The heart is displaced to the right.

STUDIES ON EXPERIMENTAL PULMONARY ATELECTASIS

1. THE PRODUCTION OF ATELECTASIS

By Walter Estell Lee, M.D., I. S. Ravdin, M.D.

AND

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In a paper published in the present number of this Journal it is reported that atelectasis was reproduced in the dog after the injection into the main bronchus of some material, removed by Doctor Clerf, from a patient suffering from this condition. The present paper is one of a series of papers to come from this laboratory on the subject of atelectasis. Previous attempts to produce experimental atelectasis by foreign bodies have been successful (Mendelssohn in 1841 and Lictheim in 1871). The more recent report of this type of atelectasis is that of Coryllos and Birnbaum, whose excellent review of the literature should be read by those interested in this subject.

The use of material removed from a clinical case has not been heretofore reported, nor has the condition been reproduced by the use of a synthetic material, similar in its viscosity to that removed from the patient. We believe that failure to reproduce this condition has been due to the inability to control the cough reflex and we further believe that with a material of proper viscosity, atelectasis can be produced at will without any alteration of the diaphragm other than that produced by the variation in the negative pressure of the pleural cavity which follows atelectasis.

In order that all of the suspected etiological factors be provided, however, the dogs were first narcotized with morphine, anæsthetized with ether, and an operative incision was made through the upper half of the right rectus muscle, entering the abdominal cavity. This wound was closed by layer sutures and then strapped with broad adhesive plaster which encircled the lower portion of the costal arches, as we dress so many of our upper abdominal wounds. Sodium amytal (sodium iso-amyl ethyl barbiturate) was injected intraperitoneally, the amounts varying from 25 to 50 mgms. per kilo. This resulted in profound anæsthesia, with abolition of the cough reflex for from five to seven hours. The dog was then laid upon his right side and the bronchoscope was introduced into the main bronchus of the right lung and 6 to 7 c.c. of the secretion previously removed by Doctor Clerf from the patient, or of the synthetic substance, introduced into the right main bronchus.

With the loss of the cough reflex, respiratory efforts became deeper and the entire mass of bronchial secretion or acacia drawn into the right bronchus. A few minutes after the completion of the introduction of the bronchial

secretion or synthetic preparation and following the removal of the bronchoscope, definite respiratory distress develops. This distress is often so marked that it seems for a time that the dog is about to die. The respiratory movements finally become regular and rhythmic although due to the amytal they are slow. The movements of the right side of the chest become restricted, while those of the left side are very much exaggerated, and there is a distinct bulging and a visible increase in the size of the left half of the thoracic cavity. The apex beat of the heart shifts to the affected side within thirty minutes to three hours.

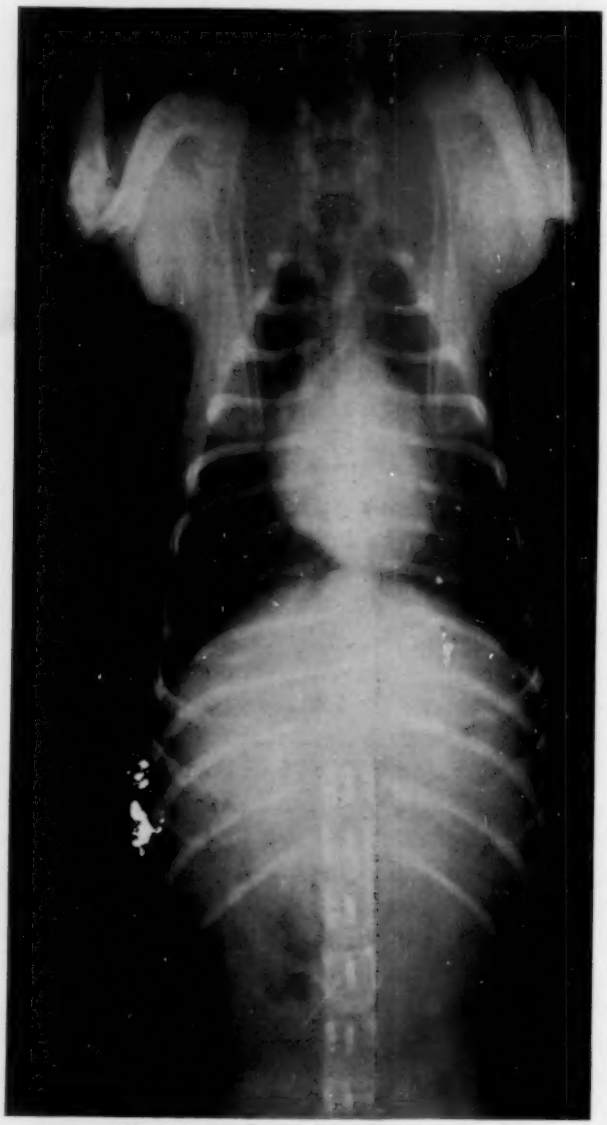

FIG. 1.—Dog 555. Laboratory of Surgical Research, University of Pennsylvania, Philadelphia. Röntgen-ray taken by Doctor Pendergrass twenty-four hours before laparotomy and the experimental production of massive post-operative atelectasis of the right lung—normal. Lee, Ravdin, Tucker.

The secretion removed from the clinical case was studied in this laboratory for its viscosity. It was found to equal in viscosity to a 100 per cent. solution of acacia (tears). This study of the material from clinical cases is being further continued and will be the subject of a later paper.

The protocols of the experimental work follows. The X-ray photographs were made in the anterior-posterior position during inspiration and expiration and a lateral film was also made.

January 11, 1928.—Dog No. 1, No. 456, a small mongrel, weighing five and two-tenths kilos, which had been given 1/6 grain of morphine per kilo, was strapped to the usual wooden operating table with all four extremities extended and lying on his back. He was anæsthetized with ether. The hair was shaved from the abdomen, the skin was scrubbed with soap and water and painted with tincture of iodine, and the iodine removed

with alcohol. Under surgical asepsis a three-inch incision was made through the median edge of the right rectus muscle into the peritoneum. This was then immediately closed with a continuous single suture of silk to close the peritoneum, a similar suture to unite the anterior sheath of the rectus muscle, and a continuous silk suture to approximate the skin and subcutaneous tissues. The wound was then painted with iodine and the upper half of it was strapped with bands of adhesive plaster about two inches wide. This band of adhesive plaster encircled the lower portion of the costal margin, with the object of immobilizing, as we sometimes do, in upper abdominal operations, the lower portion of the thoracic area.

FIG. 2.—Dog 555. Laboratory of Surgical Research, University of Pennsylvania, Philadelphia. Röntgen-ray taken by Doctor Pendergrass three hours after exploratory laparotomy and the bronchoscopic introduction of acacia into the main bronchus of right lung. Massive atelectasis right lung and transposition of heart to right of spine.

At the completion of the operation Doctor Tucker, assisted by Doctor Jackson, anæsthetized the pharynx and introduced a bronchoscope and through the bronchoscope 7 c.c. of the bronchial secretion which had been removed at 5:30 P.M. on January 9, from Cosmo Manelli, a patient at the Pennsylvania Hospital. This man developed massive collapse of both lobes of the left lung forty-eight hours after a right herniorrhaphy performed by Doctor Lee. This material had been removed by Doctor Clerf through a bronchoscope. It had been kept in the original test tube in the ice chest and pneumococci were obtained from it in pure culture. After the introduction of the bronchoscope we injected into the peritoneal cavity of the dog 260 mgms. of sodium amytal with the object of producing a deep narcosis and eliminating the cough reflex. Though the dog had been coughing immediately after the introduction of the bronchoscope, the bronchial secretion was placed in the right main bronchus and the dog was kept lying on his right side. In a very short time the cough reflex disappeared, and deep inspiratory movements drew the mucous deeply into the bronchi. A few minutes after the completion of the introduction of the bronchial secretion he seemed to have definite respiratory distress. This was at the end of or shortly following the removal of the bronchoscope. This distress was so marked that it looked as though the dog was about to die. The respiratory movements became deeper and before the dog was placed in the kennel, the movements of the right side of the chest were almost lost, while those of the left side were very much exaggerated and there was distinct bulging and a visible increase in the size of the left half of the thoracic cavity. He was kept on his right side and three hours after the completion of the instillation of the bronchial secretion into the right main bronchus he was exam-

ined with the Röntgen-ray at the University Hospital. This radiogram shows complete collapse of all lobes of the right lung with a shifting of the heart completely to the right side beyond the spinal column. Unfortunately, this picture was not developed until the following morning, the dog was sent back to the kennels where six hours after the introduction of the first dose of sodium amytal he was given 130 mgms. more. When he was found the next day he was lying upon his left side and the unilateral phenomena which was so marked on the preceding afternoon had now disappeared. A radiogram taken at this time showed that the heart had returned to its median position and that there were patchy areas scattered throughout both lungs, and we have a picture here of either diffuse lobular areas of collapse or a broncho-pneumonia.

January 12, 1928. After cocainizing the pharynx, the dog was again bronchoscoped and found a much thinner and more purulent bronchial secretion in the bronchi leading to practically all of the lobes. This was aspirated.

January 19, 1928. Dog No. 2. No. 515. A grayish mongrel weighing four and one-half kilos, was given 1½ grains of morphine at 2:30 and at 3:30 ether anæsthesia was begun. After the abdominal wall had been shaved and the skin prepared with iodine and alcohol, under surgical asepsis a three and one-half inch incision was made through the median edge of the upper half of the right rectus muscle. This incision entered the abdominal cavity, after which the peritoneum was closed by a continuous suture of silk, the anterior sheath of the rectus was closed by a similar suture of silk, while the skin and subcutaneous tissues were approximated by continuous silk suture. At the completion of this operation we injected intraperitoneally 200 mgms. of sodium amytal. Very shortly after this injection the dog's respiratory movements ceased. The heart continued beating normally and as this cessation of respiration had followed the dropping of the head over the end of the table preparatory to the introduction of the bronchoscope, the head was elevated and artificial respiration given by pressing upon the chest, and the bronchoscope was introduced without the slightest spasm or cough reflex. After some minutes the dog took a deep breath and then at the rate of about two inspirations a minute the respiration was finally reëstablished. It was thought that this respiratory arrest was due to the narcotization of the morphine. The lower portion of the thoracic cage, including the costal arches, was then strapped with a two-inch band of adhesive plaster and through the bronchoscope, which was in the right main bronchus, about 6 c.c. of the 100 per cent. acacia was introduced, which was about the estimated viscosity of the material removed from the obstructed left bronchus of Cosmo Manelli, a patient at the Pennsylvania Hospital. This acacia was introduced very easily and at the conclusion of the introduction of the 6 c.c., the bronchus was apparently occluded. During the introduction of this substance the dog lay on his right side. After the removal of the bronchoscope it seemed that the left side was moving more freely than the right and, as a matter of fact, it was questionable whether the right side was moving at all. The bronchoscope was removed at 4:15 and the dog was immediately taken over to the X-ray room at the hospital and at 4:45, thirty minutes after the completion of the insufflation of the acacia mixture, a radiogram was taken, which showed the heart completely transposed to the right side of the spinal column. This was seen first at the fluoroscopic examination and later confirmed by the X-ray picture at 8:25 P.M.

Dog No. 555, a mongrel, female, weighing five and five-tenths kilos. An exploratory laparotomy was performed on this dog under the usual technic. It was placed on the usual operating table, its extremities extended, the dog was first given 1½ grains of morphia hypodermically. It was then etherized and the skin of the lower chest and abdomen was shaved, scrubbed with soap and water and painted with tincture of iodine. An incision three inches in length was made through the right upper rectus muscle under usual surgical asepsis and the peritoneum was opened. The abdominal cavity was immediately closed by continuous silk suture to the peritoneum. A similar suture was used to unite the anterior sheath of the rectus muscle and the skin and subcutaneous tissues were approximated by a continuous silk suture. The wound was painted with tincture of

iodine and then immobilized by a two inch band of adhesive plaster which served to fix the lower thoracic cage. At the completion of this operation 175 mgms. of sodium amytal was given intraperitoneally, which was at 10:30 P.M. Doctor Tucker then introduced the bronchoscope without any difficulty, the cough reflex having been entirely inhibited by the sodium amytal. About 7 c.c. of an acacia substance with a viscosity of 128 was then introduced through the bronchoscope into the right main bronchus until there was no evidence whatever of an airway persisting. The dog was then laid on his right side and taken as quickly as possible to the X-ray room. Just thirty minutes after the introduction of the acacia substance the X-ray picture taken by Doctor Pendergrass showed complete atelectasis of all lobes of the right lung with transposition of the heart to the right of the spinal column.

DOCTOR TUCKER.—Preliminary to bronchoscopy the dog received morphine and ether anæsthesia while laparotomy was being done. Narcosis was continued with sodium amytal. The reflexes were entirely abolished on introduction of the bronchoscope. The musoca of the tracheobronchial tree is normal. A mixture prepared by Doctor Ravdin of acacia was introduced into the right main bronchus.

It was noted that a branch bronchus came from the right lung proximal to the carina. No attempt was made to introduce the mixture into this branch bronchus. The obstructing medium was introduced into the lower three lobes of the right lung. No effort at expulsion was made by coughing.

Twenty-four hours after the introduction of this substance the bronchoscopic examination of the tracheobronchial tree shows small quantities of secretion in the right bronchus with slight inflammatory reaction of the mucosa. The activity of this portion of the lung seemed to be less than on the left side. It was only possible to aspirate a very small quantity of the secretion. Reflexes were still present.

Dog No. 571, weight seven and five-tenths kilos. He received a preliminary dose of morphia, was deeply anæsthetized and then the skin was shaved over the lower thorax and the entire anterior abdominal wall. This skin was then scrubbed with soap and water and painted with tincture of iodine. An exploratory laparotomy was performed through an incision three inches in length passing through the upper half of the right rectus muscle. This wound was immmediately closed by continuous silk suture, one to the peritoneum, a second layer to unite the anterior sheath of the rectus muscle, and a third to approximate the skin and subcutaneous tissues. The wound was then painted with tincture of iodine and strapped with a two inch band of adhesive plaster to immobilize the upper abdomen and lower thoracic cage. At the completion of the operation Doctor Tucker reported as follows:

The mucosa of the tracheobronchial tree, and the bronchial movements, were normal.

There was slight reflex spasm on introduction of the bronchoscope to the bronchus. At this stage Doctor Ravdin gave the dog intraperitoneally 200 mgms. of sodium amytal and in a very short time the cough reflex was entirely lost in the deeper portions of the tracheobronchial tree. The acacia mixture was introduced through the bronchoscope into the right main bronchus. All branch bronchi below the level of the carina were filled with this mixture. It was noted that a branch bronchi came off proximally to the carina of the right lung. No effort was made to introduce the mixture into this branch bronchus.

Two hours later, on bronchoscopy, the mucosa was normal in appearance. There was no return of the reflexes. Considerable secretion was aspirated from all of the branch bronchi below the carina in the right lung. The substance had changed a great deal, being much more fluid in consistency than when introduced. The branch bronchi remained open after aspiration. It was thought by clinical examination that the lung had not reëxpanded. A very slight amount of positive pressure was used. Following this it seemed apparent that there was a definite change in the position of the heart, it moving to the left side. This observation was not entirely confirmed by fluoroscopic examination. An

X-ray picture was taken by Doctor Pendergrass very shortly after this bronchoscopic drainage, and he reported as follows:

Control films before the injection of the material show the heart to be deviated to the right slightly in inspiration, or possibly the dog was rotated slightly. The latter is more probable.

February 15, 1928, about two hours after injection of material, the examination showed atelectasis of the lower lobe on the right side and that the heart was markedly deviated to the right in both phases of respiration.

February 15, 1928. Examination of the dog shortly after removal by bronchoscopic drainage of the acacia substance which had been introduced into the right lower bronchus showed the heart to be in its normal position in both phases of respiration.

Dog No. 612, a mongrel, weighing three and five-tenths kilos. After receiving a preliminary dose of morphia and deep ether anæsthesia the skin was shaved over the lower thorax and the entire anterior abdominal wall. It was then scrubbed with soap and water and painted with tincture of iodine and an exploratory laparotomy was done through the upper right rectus muscle. The abdominal wall was closed by layer sutures of silk, a continuous suture for the peritoneum, a similar suture for the anterior sheath of the rectus muscle, and the skin and subcutaneous tissues were united by continuous silk suture. The wound was painted with iodine and then strapped with a two-inch band of adhesive plaster which immobilized the lower thoracic cage. One hundred and twenty-five mgms. of sodium amytal was then given intraperitoneally and the bronchoscope was introduced by Doctor Tucker, whose report is as follows:

The bronchoscopic examination showed no spasm of the larynx. Reflexes were entirely abolished. The mucosa of the tracheobronchial tree and the bronchial movements were normal. A mixture of acacia prepared by Doctor Ravdin with a viscosity similar to that of the original material from the human was introduced into the main bronchus of the right lung, completely blocking the branches below the level of the carina. It was noted that a branch bronchus came off from the right side of the trachea to the right lung just above the level of the carina. The substance was not introduced into this branch bronchus.

Bronchoscopy two hours later and after it has been demonstrated by the X-ray that massive collapse had occurred in the right lung and that the heart had been transposed to the right of the spine, showed the mucosa of the tracheobronchial tree to be normal. There was some secretion in all bronchial branches below the level of the carina. It is much thinner in consistency than the substance introduced bronchoscopically. The material was aspirated and the branch bronchi remained open.

The same experiment of inflation with positive pressure was carried out and it was thought to distend the lung and allow the heart to return to its normal position. This observation was based on clinical examination and not on fluoroscopic examination.

X-ray report by Doctor Pendergrass was as follows:

The control films made before any experimental work was done showed the heart to be in the normal position and not displaced in the two phases of respiration. February 15, 1928, about two hours after the injection of the acacia substance the heart was found displaced to the right in both phases of respiration, but more on inspiration. The lateral view showed definite atelectasis of the lung.

February 15, 1928. A very short time after the bronchoscopic removal of the acacia substance by Doctor Tucker the heart was found to have returned to its normal position in both phases of respiration. A slight amount of atelectasis or lung reaction is present in both lungs.

THE DUODENAL TUBE AS AN AID IN THE SURGICAL TREATMENT OF EXOPHTHALMIC GOITRE

PRELIMINARY REPORT OF THIRTY CASES

By Arnold S. Jackson, M.D.

of Madison, Wisconsin

FROM THE JACKSON CLINIC

Since the introduction of the use of iodin in 1922, in the pre-operative and post-operative treatment of exophthalmic goitre at the Jackson Clinic, no deaths have resulted from hyperthyroidism. Many patients have been admitted in crisis; frequently they were delirious and sometimes even moribund. Yet, by the administration of iodin, of fluids, and by careful nursing recovery was made possible in every case. In some instances iodin could be administered only through the rectal or duodenal tube. In no instance was it necessary to resort to intravenous medication.

In 1923, in a series of cases of exophthalmic goitre in the Clinic, it was shown that such marked benefit resulted from the use of iodin that it was possible to perform primary thyroidectomy in 75 per cent. of the cases. This report was refused by a leading medical journal because the procedure was looked on as too radical a departure. When Plummer pointed out that iodin was beneficial and was not harmful in exophthalmic goitre is seemed at first that most of the medical profession were slow to be convinced. This may have been the natural sequence of former disappointments. It is a question whether more imagination and less skepticism might have paved the way for more such discoveries. Iodin might have come into common usage in the treatment of exophthalmic goitre when Basedow first called attention to the benefit derived, or again when Trousseau pointed this out in 1864, or even in 1912 when Marine emphasized this fact.

While the statement made in 1923, that under the proper conditions it was possible to eliminate the ligation and stage operations in all but 25 per cent. of the cases was considered too radical, it is now known that it was too conservative. Since 1924, only one ligation has been performed at the Jackson Clinic, and in this single instance it was entirely needless. During this time more than 200 primary thyroidectomies for exophthalmic goitre have been performed. Death did not result from post-operative hyperthyroidism, but a number of severe reactions occurred until our present knowledge was gained.

When iodin was first used successfully in conjunction with surgery in the treatment of exophthalmic goitre, the drug was administered with caution and in small amounts. In 1924, I became convinced that better results could be obtained if large doses were given both pre-operatively and post-operatively.

It appeared that the degree of reaction occurring after operation could be largely controlled by the amount of iodin. This was also true of the operation itself. Not only was the clinical condition remarkably improved so that the patient required no general anæsthesia, but thyroidectomy was greatly simplified because the gland was less vascular and friable. Gross pathologic study confirmed this observation and in 1925, I demonstrated microscopically the transition from hyperplasia to colloid.[3] Since then, however, Marine has shown me slides that he prepared in 1912, with the same observation. Unfortunately the remarkable effect that he observed did not become generally known, and not until eighteen years later did Plummer revolutionize the treatment of this disease. If these facts had only been conclusively proved by Trousseau, Kocher, or even Marine, thousands of needless ligations and stage operations could have been eliminated, and many deaths might have been prevented.

There are certain qualifications to be made regarding the statement that primary thyroidectomy may be performed in practically all cases of exophthalmic goitre. Even in the hands of the most skilled operator unfortunate results occur because of the failure to attend to certain details. In thyroid surgery it is the little things that make the big things. There must be infinite attention in the care of the patient from the time he is first seen until he is finally dismissed from observation. To begin with, the patient's confidence must be won and the surgeon's experience has taught him that among other things it is advantageous to allow contact with patients who have already been operated on. The patient cannot be successfully cared for by untrained nurses. They must be keen, alert and above all, experienced. The condition of a goitre patient can change for better or worse in a few hours, depending on the nurse. The mere method of administering iodin is a simple matter and yet failure to use the proper methods nearly cost the lives of two patients I was called to see. The proper assistance in the operating room, the type of anæsthesia, and the experience of the surgeon are all factors that influence the successful outcome of thyroidectomy.

If one can count on all these conditions as being favorable and if the patient has received the proper amount of preparation, I believe that in the majority of instances primary thyroidectomy may be performed. Certain reservations must of course be made as, for example, when hyperthyroidism has persisted over such a long period that the heart is badly decompensated. Only occasionally age might be a factor. Neither of these conditions, however, has given me concern. The greatest risks occur when patients have been given iodin for many months until they have developed tolerance to it. In these cases I have learned that by greatly increasing their usual dosage, that is, giving 120 drops or more a day, they may be put in fair condition for operation. In such instances one may expect considerable post-operative reaction.

Before iodin was used in the treatment of exophthalmic goitre, post-operative hyperthyroidism was evidenced by a greatly accelerated pulse rate, extreme restlessness, and nervousness verging on delirium, fever with rapidly mount-

ing temperature, and gastro-intestinal crisis. The reaction as it is now observed is greatly modified, but in the more toxic cases the pulse rate may rise to 160 or more for a day or two; repeated emesis may occur and the temperature at times reaches 103° F. All of these symptoms are largely controlled by iodin, provided this is retained.

Frequently, however, the liquid given by proctoclysis is expelled and emesis occurs almost as soon as the iodin is swallowed. At times the iodin even if well diluted seems to irritate the larynx causing an excess of mucus. To control these symptoms the duodenal tube was tried as a means of introducing iodin. This method has now been used in thirty cases and it has proved greatly beneficial. (Tabulation.)

SUMMARY OF THIRTY CASES

Factors	Average
Age	38.6 years
Duration of disease	15 weeks
Loss of weight	33.5 pounds
Days of preparation	9
Basal metabolic rate on admission	plus 65 per cent.
Basal metabolic rate after administration of iodin	plus 46 per cent.
Basal metabolic rate on discharge	plus 11 per cent.
Pulse rate on admission	132
Pulse rate after administration of iodin	94
Pulse rate after thyroidectomy (maximal)	122
Temperature after thyroidectomy (maximal)	102.3° F.
Days in bed after operation	4.5

In order to perform primary thyroidectomy in all cases, various methods have constantly been studied to reduce post-operative reaction. Certain nurses were especially trained to care for these patients, so that they might be familiar with every detail. For the past two years, at the suggestion of Dr. Harold E. Marsh, each patient was given 30 gm. of glucose and 100 gm. of orange juice two hours before operation. Lugol's solution, four doses of 10 drops each, has been given preceding thyroidectomy. All patients received ¼ grain morphin and 1/300 grain scopolamin an hour before operation. This procedure together with local anæsthesia has been used for the past eight years at the Clinic and has proved entirely successful. Patients leave the operating table in practically the same general condition as before the operation. Only rarely it may be necessary to resort to nitrous oxid and then one is impressed with the fact that the patient is no longer under the control of the surgeon but rather of the anæsthetist. The increased venous congestion adds to the difficulties of the surgeon because of the increased hemorrhage.

Although the degree of post-operative reaction was considerably modified by these measures, there still remained a certain group of cases that caused some apprehension. These were the patients who were troubled with mucus or repeated emesis. It seemed that if the iodin could be introduced directly into the duodenum these difficulties could be overcome. The first case in

which the duodenal tube was used, was that of an extremely toxic patient who previous to treatment registered a basal metabolic rate of plus 86 per cent. Thyroidectomy was successful under local anæsthesia, but during the afternoon it was impossible for the patient to retain iodin either by mouth or rectum. At five o'clock a duodenal tube was passed, iodin and fluids were introduced freely and within thirty minutes the patient's condition had improved so remarkably that satisfactory recovery was practically certain.

The next case in which the tube was used was that of another extremely toxic patient. He showed signs of developing pneumonia through the accumulation of excessive mucus that was apparently due to irritation of the larynx from iodin. The tube was passed and the tendency to formation of mucus greatly reduced by introducing iodin and fluids directly into the duodenum.

While the use of large doses of iodin, glucose, and orange juice preceding operation has modified post-operative reaction, the most important factor in my experience, since the introduction of iodin, has been the use of the duodenal tube before, during, and after operation. As a result of early experience, it was decided to introduce the tube the afternoon before operation. This allowed the patient to adjust himself to the tube and at the same time by use of the Murphy drip gave assurance that even while the patient was asleep, fluids, nourishment, and iodin were being absorbed. The patients now come to the operating room under ideal conditions. The period of time that formerly elapsed previous to operation in which the patient received no fluids or iodin is now eliminated. These ideal conditions are enhanced by the fact that any tendency to hyperthyroidism that might develop is held in check by the constant introduction of iodin, fluids, and nourishment through the tube while the patient is on the operating table. The duodenal tube is attached by a rubber tube to an ordinary proctoclysis can suspended on a standard. It causes little or no annoyance to the patient; some actually prefer to allow the tube to remain rather than to undergo the exertion of swallowing.

I have always felt that, no matter how serious the case, if operation was to be performed at all, primary thyroidectomy could be as safely done as ligation or the stage operation, provided it could be performed under ideal conditions. The use of the duodenal tube has supplied the one needed factor, that of insuring a constant intake of iodin, fluids, and nourishment, without increasing the amount of mucus.

Since using the tube the post-operative reaction occurring in cases I have observed has been negligible. These include elderly patients, long standing cases, children, and serious cases in which the patient has been on iodin treatment for a long time.

As a rule the tube is withdrawn in forty-eight hours; occasionally it is removed sooner, or is allowed to remain another day. Patients often experience a mild crisis on the day after operation; if however their condition is good at this time and the intake of fluids has been satisfactory the tube may be removed. In two cases the tube appeared to hinder the patient from expec-

torating mucus and as it seemed to have served its purpose it was removed.

I have not felt it necessary to use the tube in every case, but only when more than the usual degree of post-operative reaction is anticipated. While the degree of reaction that may be expected cannot be absolutely predicted, it is always possible to introduce the tube after operation.

Although the ligation operation has been safely discarded in the Clinic, I hesitate to emphasize such a statement. However, I feel that our patients are submitting to thyroidectomy under very favorable conditions. For those who perform an occasional operation without the advantages of an especially trained staff, it would perhaps be advisable to proceed with more caution. A ligation operation need no longer be looked on as a means of temporarily improving the patient's condition, but rather as a test of his ability to withstand more extensive surgery. Nor should thyroidectomy itself be considered with impunity, because the more radical operation as performed today is undertaken with greater risk than was recently the less extensive procedure.

To those who are daily engaged in thyroid surgery, the duodenal tube is suggested as a means of modifying post-operative reaction. To those who occasionally perform such operations the tube is suggested as a helpful measure for either the ligation stage, or primary thyroidectomy.

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THE THERAPEUTIC VALUE OF IRRADIATION IN THE TREATMENT OF MAMMARY CANCER

A SURVEY OF FIVE-YEAR RESULTS IN 355 CASES TREATED AT THE MEMORIAL HOSPITAL OF NEW YORK

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This paper represents an analysis of the results obtained by irradiation, with and without surgery, in 182 primary operable and 173 primary inoperable cases, admitted to the Breast Clinic, five years or more ago. Our effort has not been directed to prove irradiation effective, but to ascertain its value, if it had any. The patients have been followed continually, the percentage of the follow-up being 97.2 per cent.

We will first discuss the technic of irradiation.

TECHNIC OF IRRADIATION

The large literature which has accumulated upon irradiation methods and dosage, attests both the difficulties and the importance of the problem. A gradual improvement in technic has resulted, from the employment of better X-ray equipment, more satisfactory radium applicators and an accumulation of data from the physical and pathological laboratories. Most of the patients, in this report, received the major portion of their treatment before these more effective methods had been developed.

Treatment by X-rays.—Until the year 1920, the only Röntgen-ray machines in use at the Memorial Hospital for therapeutic purposes, were those of the so-called low-voltage type. The treatment was given in cycles, each cycle including from four to six treatments. The whole breast and adjacent regions were divided into four or six areas, each area being treated on successive or alternate days, until all had been irradiated. This type of treatment was given, in some instances, for months, with little or no intermission between cycles. While subject to considerable variation, the set-up for delivering the dose was as follows: A peak voltage varying between 120–135 K.V., 5 milliamperes of current, 3 to 4 millimetres of aluminum filter, a focal distance of 8 to 8¾ inches, and a treatment time of 3 to 6 minutes. Later, the time was lengthened to 7 or 8 minutes, the focal skin distance increased to 9 or 10 inches, but the number of aluminum filters was unchanged. We have, arbitrarily, called this form of X-ray treatment, L. V. 1.

A review of our earlier clinical records reveals a considerable latitude in planning and delivering X-ray dosage. Although our experience was meagre, the treatment of each patient was considered an individual problem, to be dealt with as the best clinical judgment would dictate. A large corpulent

subject was treated with a large portal of entry, the focal skin distance being also increased, if the tumor lay at a considerable depth. Superficial foci in the skin and subcutaneous tissue responded more readily to this form of therapy, but some of the deeper lesions also showed a considerable degree of regression, when persistent and repeated treatments were continued over a long period of time.

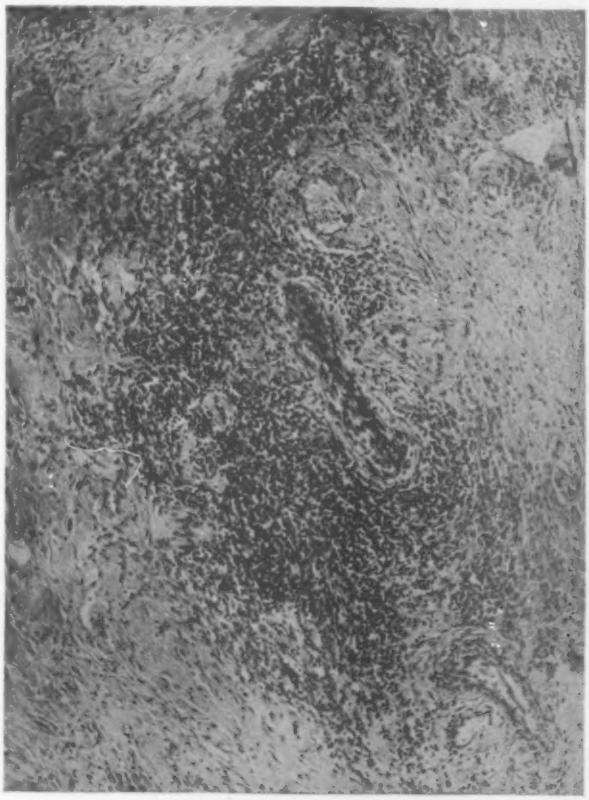


FIG. 1.—Carcinoma of the breast following irradiation. Section shows hyalinization and lymphocytic infiltration.

It seemed probable that a more intensive type of treatment would yield more satisfactory results and accordingly, about 1921, the low-voltage technic was considerably modified. The set-up included a peak voltage of about 140 K.V., 4 milliamperes of current, 4 millimetres of aluminum filter, a 10 to 12 inch target skin distance and a 15 minute exposure. The size of the skin areas exposed was not constant, but the average portal used was, approximately, 300 square centimetres. We designated this mode of treatment, L. V. 2. This method seemed more effective in delivering a dose to a tumor at a depth. More satisfactory regressions and more pronounced histological changes were obtained, in shorter periods of time, than had been possible with the L. V. 1 type of therapy.

The desire to approximate the intensity of radiation obtained by the new high-voltage machines led to a further modification in low-voltage technic in 1922. With the same peak voltage of 140 K.V., using 4 milliamperes of current, 5 millimetres of aluminum filter and an average portal of entry of 300 square centimetres, the focal skin distance was increased to 15 inches and the time to 25 minutes. This type of treatment has been designated, L. V. 3. The regressions in deeper tumors obtained by this newer technic seemed more often satisfactory than with either of the two former methods.

During the past five years, high-voltage therapy has been utilized as one of the methods of treatment in dealing with mammary cancer by irradiation. The regressions obtained by its use, in general, have been more pronounced

than by any of the previous low-voltage methods. The massive dose technic, begun in Germany, has had many adherents in this country, but at the Memorial Hospital, the so-called, divided dose method, has been considered safer therapy. The set-up with our treatment by high-voltage has been as follows: A peak voltage of 180 to 200 K.V.; 4 milliamperes of current; ½ millimetre of copper and 1 millimetre of aluminum filter; with a portal of entry of about 300 square centimetres, a target skin distance of 50 centimetres was used. The time of exposure has varied from 60 to 80 minutes, the former delivering a suberythema dose, while the latter has usually produced a distinct erythema. This type of therapy has been designated H. V.

Mrs. Edith H. Quimby, of the physical laboratory, has furnished the following table, indicating the effect of the size of the diaphragm on the quantity of radiation reaching a given point. The results in this table are based on experimental work. The values for the 10 x 10 centimetre diaphragm have been used as standard, and the change in both surface and depth doses for other diaphragms given. The work has not been done for the lower voltages, but there would be a similar variation in intensity of about the same magnitude.

TABLE I.

Effect of Size of Diaphragm on Quantity of Radiation Reaching a Given Point.

200 K.V. 50 cm. F.S. Distance 0.5 mm. Cu. & 1 mm. Al.

Depth cm.	Diaphragm Area Sq. cm					
	600	400	200	100	50	25
0	116	114	104	*100*	93	86
2	109	108	99	*94*	85	74
5	85	82	72	*66*	56	44
10	48	46	37	*33*	26	21
15	30	27	22	*17*	13	10

The larger the portal of entry, the larger is the dose delivered to tissue at any depth, because of the added amount of scattered radiation. For example, let us compare the quantities of radiation obtained with a portal of 25 square centimetres to those with a portal of 100 square centimetres. At the skin surface, the smaller portal provides 86 per cent. of that obtained with the larger diaphragm. At a depth of 5 centimetres, but 66 per cent. is delivered, while at a depth of 15 centimetres the figure falls to 17 per cent.

It is apparent that the portal of entry is an important factor in dosage, and it must be recorded for a proper estimation of the dose delivered.

Mrs. Quimby has, also, furnished the following table showing depth doses for various types of irradiation. The data for L. V. 2, high-voltage, and the 6 and 10 centimetre packs are experimental. Those for L. V. 1, L. V. 3 and the tray are calculated.

If one compares the percentages of skin erythema dose delivered by

L. V. 1 and H. V. at a depth of 7 centimetres, but 1/3 of the skin dose is delivered by the former, while ½ is delivered by the latter. With a depth of 10 centimetres, the percentages are 18 per cent. and 33 per cent. Leaving out of consideration the quality of radiation which these types of X-rays deliver, it is apparent that the higher voltages should be more effective in dealing with tumor tissue at a depth.

TABLE II.

Depth Doses for Various Types of Radiation.

Depth cm.	L.V. 1	L.V. 2	L.V. 3	High Voltage	Radium Pack 6 cm.	Radium Pack 10 cm.	Radium Tray 3 cm.
0	100	100	100	100	100	100	100
2	72	76	78	94	55	61	36
4	53	55	58	75	36	46	17
7	33	36	39	51	21	31	7
10	18	20	22	33	14	21	
15	7	8	9	17	8	12	
20				8	5	8	

It is important to note that almost all of the cases in this report have been treated by low-voltage methods, and a majority of them have received only the L. V. 1 type of radiation.

Radium Therapy.—Clinical experience seems to indicate that the gamma rays of radium, with their shorter wave lengths, probably produce a different therapeutic effect upon tumor tissue than do X-rays. Aside from its use as an external agent, radium is available for interstitial irradiation, permitting more varied types of therapy. Radium has been employed externally in the form of a pack or tray, and interstitially, in the form of glass emanation tubes or platinum needles.

Pack.—In the earlier years of treatment the pack was constructed, having an area of 70 square centimetres and a filtration of ½ millimetre of silver and 2 millimetres of lead. Placed at a distance of 6 centimetres, the average dosage employed was 12,000 millicurie hours. The radium pack carried an amount of emanation varying from 1200 to 2500 millicuries, the emanation tubes being distributed as uniformly as possible in the container. The present pack differs from the one just described in the total filtration, which is now ½ millimetre of silver and 1 millimetre of brass, being equivalent to 2 millimetres of brass. In treating breast lesions and axillary and supraclavicular disease, the distance has been 6 centimetres from the skin.

With the new pack, at first, a dosage of 8000 millicurie hours was employed, which, on account of the lower filtration, was the approximate equivalent of 12,000 millicurie hours, when the older type of pack was used. Later the dosage was raised to 9000 millicurie hours, then 10,000, and more recently to 12,000 millicurie hours. In the average patient, the latter dose produces a well-marked erythema and occasionally blistering. Our best results with the 6 centimetre pack have been obtained by cross-firing on either side

of a breast tumor with a full erythema dose; or by repeated treatments of supraclavicular nodes and large recurrences or metastases of the chest wall. Many satisfactory regressions in metastases to bone, especially in the spine, have occurred in using the 6 centimetre pack; when the distance has been increased to 10 centimetres and a dosage of 18,000 to 20,000 millicurie hours used, still better results have been obtained. Our most striking regressions have occurred when both high-voltage X-rays and the radium pack have been employed over identical areas, an interval of only two or three days intervening between treatments.

FIG. 2.—Radiation effects in mammary cancer; fragmentation and hyperchromatism of nuclei, hydropic degeneration of cells and necrosis.

Tray.—The radium tray is a small applicator 4 x 6 cm. in size, designed for the treatment of smaller lesions, the filtration being the same as for the pack. The amount of radium available is usually 1000 millicuries, and with a dosage of 3000 millicurie hours at 3 centimetres distance, a fairly full erythema appears. Our best results in the use of the tray have been obtained in the treatment of recurrences of the chest wall, small primary tumors of the breast, or metastases in the lower part of the axilla. Combined with high-voltage, it has been still more effective.

Interstitial Irradiation.—This form of irradiation has been given, employing glass emanation tubes or platinum needles.

Glass Emanation Tubes.—These emanation tubes have often been termed "bare tubes," as no filter, save the glass, was provided. The implantation of these tubes into tumor tissue has been accomplished by means of needle trocars, with a minute metal plunger. One tube with a value of 1 to 1.5 millicuries was introduced into each c.c. of tumor tissue to be treated. In treating a small neoplasm, an even distribution of bare tubes was possible. A disadvantage arose in connection with the use of bare tubes, from the inflammatory

reaction induced by the beta rays, which the glass does not filter out. Frequently, this inflammation was marked, the patient suffering considerable discomfort and pain. Nevertheless, some of our best results in the primary operable cases treated by radiation have been obtained by the use of bare tubes, in small localized carcinomas of the breast.

Platinum Needles.—When larger tumors were to be irradiated, platinum needles, with a filtration of 0.4 millimetre of platinum have been employed, as it was impossible to implant bare tubes uniformly throughout the mass. The needles were spaced about 2 centimetres apart. The immediate regressions were striking, in some of the early cases treated with these needles. With a dose as small as 70 millicurie hours per needle, some tumors regressed and have remained quiescent over a period of years. We now know that these dosages were wholly ineffectual to completely destroy the lesion. The dose has been increased to 700 millicurie hours per needle for the primary tumor, and 500 to 600 millicurie hours for the treatment of metastases to axillary nodes. The needles should never be introduced nearer the brachial plexus than 2 to 3 centimetres, for otherwise an intractable and distressing neuritis may result. Such a complication has arisen in but two of the patients in this series.

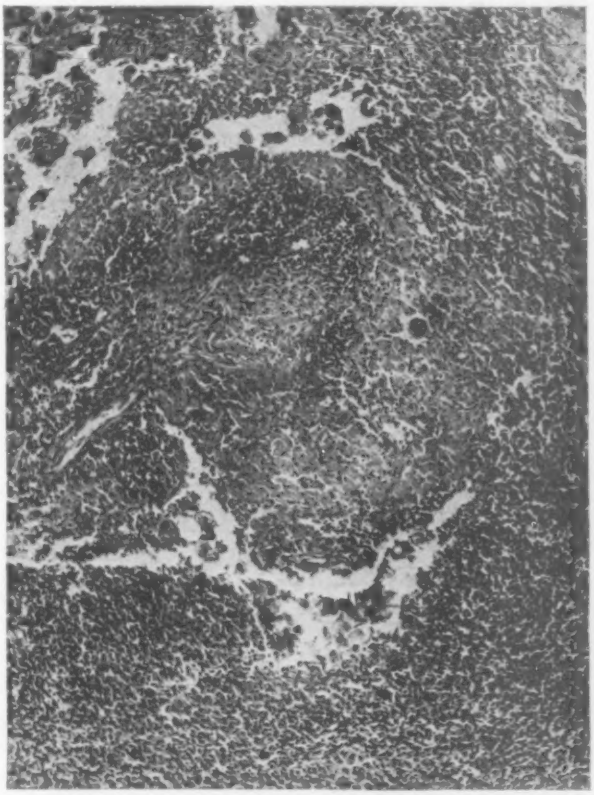


FIG. 3.—Necrosis of cells in mammary cancer following irradiation.

Limitations of Radium and Röntgen-ray Therapy.—Light-complexioned individuals, and especially those with reddish hair and ruddy complexions, develop a skin erythema more readily than do brunettes. In treating the former, a dosage less than the average should be planned and given, or skin damage may follow. Upon the other hand, anemic and under-nourished individuals develop an erythema less readily than does the average patient.

The general condition of the patient must be borne in mind, in planning any form of radiation treatment. An individual in poor general condition

should not be subjected to prolonged or heavy irradiation, for such a patient does not react well to the use of these agents, and the local lesion regresses less satisfactorily. In this group, the best result that may be hoped for, is a certain degree of palliation.

The adjacent normal tissues irradiated have a limit of tolerance. The skin will stand only a certain amount at any single dose, and repetitions of treatment may not be carried on indefinitely or skin destruction will surely follow. This untoward accident occurred in a few of the earlier cases treated, but no such complication has arisen in recent years.

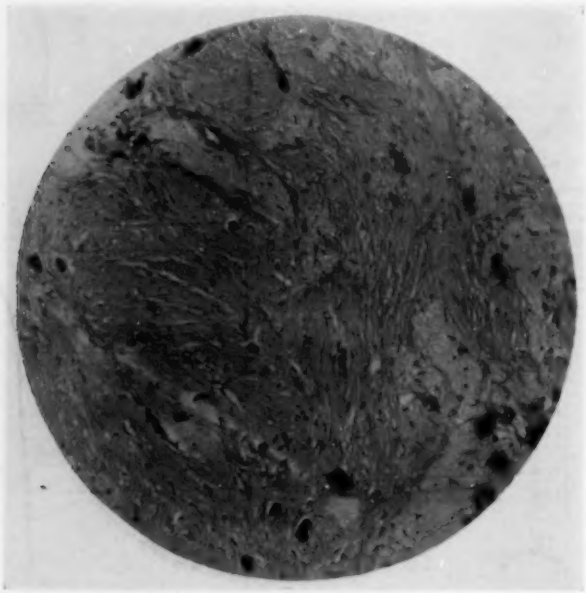


FIG. 4.—Hyalinization in mammary cancer produced by radiation.

The subcutaneous tissue atrophies with prolonged irradiation, associated with a gradually diminishing blood supply, and treatment here, also, has definite limitations. In dealing with chest metastasis, the lung tissue is likewise irradiated, and numerous cases have been reported in the literature of diffuse and sometimes fatal pulmonary fibrosis, following a prolonged series of heavy high-voltage treatments of the chest. No case of extensive or fatal pulmonary fibrosis had ever occurred at the Memorial Hospital as far as our knowledge goes.

In treating metastasis to supraclavicular nodes by external radiation, persistent treatment may result in an intractable neuritis of the brachial plexus. One patient, in the present series, suffered from this complication, following the use of four radium packs and four high-voltage treatments over one supraclavicular area.

Late Skin Changes Following Radiation.—When the L. V. 1 type of treatment has been used over a long period, considerable skin atrophy and small telangiectases may appear, two or three years later. In many cases these have increased in size and number, often covering the entire irradiated area. Observed year by year, a few of these patients have exhibited skin changes, which were progressive, and ultimately, areas of ulceration made their appearance. In two instances, a squamous-cell epithelioma developed in the over-irradiated skin. In one case, a wide surgical removal of the diseased area, done six years ago, has been successful in eradicating the disease.

The second patient has, up to the present writing, refused operative interference.

Gross and Microscopic Changes in Tumor Tissue Induced by Radiation.—Gross Changes: When adequate external radiation is used or the interstitial method employed, or when the two methods are combined, changes occur in the tumors treated with varying degrees of response, for tumors differ with respect to their radio-sensitivity, the more cellular being uniformly the more radio-sensitive. Marked regression in size was observed in some of the more cellular neoplasms, within two to four weeks from the time of treatment. Complete disappearance of the mass followed in a few instances. We now consider that a marked diminution in the size of a breast tumor or its complete disappearance, following irradiation, is trustworthy evidence of cancer. Therefore, this reaction is of diagnostic value, no other tumor of the mammary gland responding to radiation in this characteristic way. Exceptionally, a cancer of the breast may show little or no regression following irradiation.

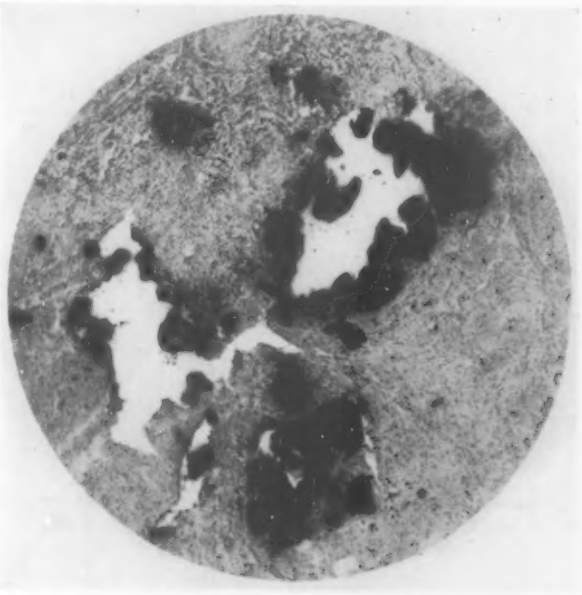


FIG. 5.—Late radiation effect in mammary cancer. Extreme degree of calcification.

When mammary carcinoma, which has been adequately irradiated, is sectioned, certain gross changes are evident, consisting of small areas of necrosis or liquefaction, representing devitalized masses of tumor cells and stroma. Necrosis throughout the entire tumor is unusual. These areas are more frequently encountered when interstitial radiation has been employed, and may extend 1 to 2 centimetres on all sides of the site of radium implantation.

Microscopic Changes.—The material available in the pathological laboratory has permitted the study of a considerable number of cases, showing radiation effects. The histological evidence of changes in cancerous tissue, induced by radiation, may be summarized as follows: Hyalinization of connective tissue, granular degeneration of the stroma, obliterating endarteritis, granular or hydropic degeneration of the cell cytoplasm, hyperchromatism, fragmentation or degeneration of nuclei, lymphocytic and plasma cell infiltration, considerable areas of necrosis, and occasionally in tumors, following prolonged irradiation, calcification. The limits of the present paper will not permit a further discussion of these changes.

PRIMARY OPERABLE PATIENTS

Patients were placed in this series, based upon criteria, which the writer has outlined in previous papers. The cases have been studied in the three following groups.

Group A.	Received pre-operative irradiation, radical surgery and post-operative irradiation	41
Group B.	Received radical surgery and post-operative irradiation	76
Group C.	Treated by irradiation with or without palliative surgery	45
	Total	162

Twenty patients were excluded from these groups for reasons indicated in Table III.

TABLE III.

Results in Primary Operable Patients.

Group	No.	Alive Well	Alive Recurrent	Dead	Dead of Intercurrent Disease	Lost Track	% 5-yr. Results
A Pre-operative Irradiation, Surgery, Post-operative Irradiation	41	14	1	24	2 [after 5 yrs.]	0	39
B Surgery Post-operative Irradiation	76	26	0	49	0	1	35
C Irradiation	45	11	1	22	6 [2 after 5 yrs.]	5	36
Pre-operative Irradiation, Surgery	7	4	0	3	0	0	57
Surgery Irradiation for Recurrence	5	2	0	3	0	0	40
Surgery Alone	1	1					100
Irradiation 3 yrs. later Surgery	1	1					100
Local Excision Irradiation	6	2		3	1 [after 5 yrs.]		50

Patients dying from intercurrent disease, after the five-year period, but with no evidence of cancer, have been considered five year satisfactory results. Patients dying from intercurrent disease, before the expiration of the five years, but without evidence of cancer, have been excluded from statistical study, as well as those who have been completely lost track of.

This series offers an opportunity for a comparative study of results in the treatment of mammary carcinoma by radical surgery, combined with irradiation, as compared with those obtained by the use of physical agents alone. Moreover, it permits an evaluation of the efficacy of the types of pre-operative and post-operative irradiation, which we have employed. It also affords a comparison of results achieved by radical surgery, plus irradiation with

those obtained by radical surgery alone, the latter group having been presented by the writer and an associate to this Association in 1924.

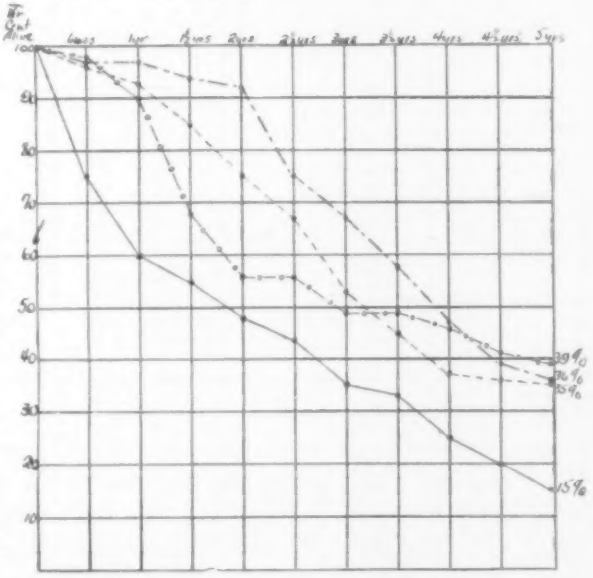
These groups may also be compared from the standpoint of total duration of disease and duration after treatment.

TABLE IV.
Duration of Disease.
(Primary Operable Patients.)

Group	Total Duration		Duration after treatment	
Surgery Alone	4 yrs. 1 mo.	66 pts.	3 yrs.	70 pts.
Pre-operative Irradiation Surgery Post-operative Irradiation	5 yrs. 2 mos.	40 pts.	3 yrs. 9 mos.	41 pts.
Surgery Post-operative Irradiation	5 yrs. 1 mo.	74 pts.	4 yrs. 3 mos.	75 pts.
Radiation Alone or with Palliative Surgery	5 yrs. 10 mos.	45 pts.	4 yrs. 6 mos.	45 pts.

The following graph illustrates the percentage, alive and well, without recurrence, at six months' intervals in each group.

A study of Table III and the graph indicates no apparent advantage in favor of surgery, combined with irradiation, over treatment by irradiation alone. From a statistical standpoint, the figures are identical, for the difference in percentages is too slight to be significant. Either much larger groups must be studied, or these three groups followed for a longer period of years, for then a considerable divergence in percentages would be of real significance.



GRAPH 1.—Graph showing per cent. alive without recurrence at six-month intervals up to five years. Primary operable group. Forty-five patients, radiation alone or with palliative surgery _ _ _ _ _. Forty-one patients, pre-operative, surgery, post-operative —o—o—. Seventy-six patients, surgery, post-operative _ _ _ _ _ _ _. Seventy-five patients, surgery alone _____.

One striking conclusion to be drawn from the graph is, that mammary cancer treated by surgery alone, gives a lower percentage of satisfactory five year results than any of the radiation groups. However, the writer desires

to point out that the percentage figures obtained by us when surgery alone was used are much lower than those reported by numerous other clinics.

When we consider the duration of disease after treatment, as outlined in Table IV, we find that the cases treated by irradiation alone showed a longer average duration than any of the other three groups, while those treated by radical surgery alone showed the shortest duration.

Age of the Patients.—In the selection of patients for treatment by physical agents alone, we chose older women in whom operation seemed a more formidable procedure and in whom a trial with irradiation seemed justifiable. Surgical experience has shown that advanced age presents no unusual hazards in connection with radical amputation of the breast. Nevertheless, a major operation does loom rather large in the mind of the average patient sixty-five or seventy years of age, and much may be accomplished in such a case, by the growth restraint which follows irradiation.

When the patients in the primary operable series are classified according to decades, the results are shown in the following table:

TABLE V.

Age of the Patients.

(Primary Operable Group.)

Decades	Group A Pre-operative Irradiation Surgery Post-operative Irradiation	Group B Surgery Post-operative Irradiation	Group C Irradiation	Total
21–30.....	0	3	1	4
31–40.....	8	14	1	23
41–50.....	14	33	7	54
51–60.....	13	16	5	34
61–70.....	3	8	11	22
Over 70.....	3	0	11	14
	41 Patients	74 Patients	36 Patients	151
	15% over 60 7% over 70	11% over 60 none over 70	61% over 60 31% over 70	

This table shows that the irradiation group contained a striking preponderance of older women in whom the disease is usually less active and correspondingly less menacing. This group should have had a higher percentage figure of satisfactory five year results than the other two groups, but such does not prove to be the case. Therefore, the age comparison shows radiation alone at a disadvantage as compared with treatment by surgery and radiation combined.

But advanced age was not the only determining factor for the selection of cases for radio-therapy. Several patients suffering from intercurrent disease, such as diabetes, serious cardiac ailment and tuberculosis, were also chosen for treatment. A few patients rejected operation and some of the

remaining were advised to rely upon irradiation methods for the control of the disease, as the clinical setting seemed favorable for use of physical agents.

PATHOLOGICAL HISTOLOGY

Although adequate pathological data were at hand for making histological diagnosis in the pre-operative, surgical post-operative patients, tissue for pathological examination was obtained in but thirty-one patients (69 per cent.) in the irradiation series. Consequently, no pathological diagnosis has been possible in one-third of the irradiation patients. In the surgical post-operative group, pathological reports or slides have been obtained wherever possible. Following is a table of the pathological types encountered in the primary operable group:

PRIMARY OPERABLE GROUP

Pre-operative Irradiation Surgery, Post-operative Irradiation	
Carcinoma Simplex	12
alveolar	8
fibro	5
Comedo Carcinoma	4
Adenocarcinoma	2
cellular papillary	3
sweat gland type infiltrating	1
arising in ducts	1
Paget's Disease	2
Carcinoma—type not stated	3
	41
Surgery, Post-operative Irradiation	
Carcinoma Simplex	8
alveolar	5
duct carcinoma	1
fibro	21
sweat gland type	4
Comedo Carcinoma	2
Adenocarcinoma	11
cellular	4
papillary	1
papillary cyst	1
Squamous Cell Carcinoma	1
Carcinoma—type not stated	9
	68
Irradiation Alone, or with Palliative Surgery	
Carcinoma Simplex	9
alveolar	4
fibro	5
sweat gland type	3
Adenocarcinoma	1
mucous	1
papillary	2
Paget's Disease	2
Carcinoma—type not stated	4
	31

Pre-operative Irradiation Surgery

Carcinoma Simplex	2
fibro	2
Comedo Carcinocarcinoma	1
Adenocarcinoma	1
	6

Surgery, Irradiation for Recurrence

Carcinoma Simplex	1
Adenocarcinoma	2
Carcinoma—type not stated	1
	4

Surgery Alone

Adenocarcinoma	1

Irradiation (3 years later, Surgery)

Carcinoma—type not stated	1

In the irradiation group, sections have been taken, when it could be done without detriment to the patient's best interest. At times it was difficult to remove tissue from a tumor close to the skin without leaving, at the site of section, a small tract leading down to the tumor, adding the additional hazard of infection. Furthermore, such a procedure may disseminate the disease by floating tumor cells into adjacent lymphatics or venules. We are convinced that a clinical diagnosis of carcinoma of the breast, made without mental reservation, and corroborated by several competent surgeons, should not be questioned. Where a reasonable doubt exists as to the presence of cancer, a section should be taken or the tumor excised locally. This has been the rule in the present series.

It is difficult to grade histologically, according to degrees of malignancy, the patients in the three major groups in the foregoing table. However, one broad generalization can be made, namely: that the irradiation patients had less malignant types of the disease, from the standpoint of histology, than those treated by a combination of surgery and irradiation.

Palliative Surgery.—In ten of the patients in the irradiation group, some type of palliative surgery was performed.—A local excision, axillary dissection or palliative mastectomy. One may question the wisdom of placing such cases in the irradiation group. They were included because palliative surgery was incidental to the treatment by radiation. Palliative operations were done because ulceration was imminent or the tissue changes precluded further irradiation.

Adequacy of Radiation in the Irradiation Group.—Despite the relatively poorer showing made by the irradiation cases, one may ask whether these patients received adequate radiation. Most of the treatment was given five or more years ago, and was necessarily empirical, as accurate data for dosage had not accumulated. Many patients were treated entirely by the old type, low-voltage X-ray machines, and much of the treatment was inadequate, in the

light of our present knowledge. Radium was, as yet, an untried agent, of great potency and some of the patients received over-dosage, with considerable damage to normal structures; others were given wholly inadequate treatment to properly care for the lesions. Irradiation has been passing through a process of evolution, and final judgment concerning its efficiency must be withheld for several years.

The Comparative Efficacy of Radium and X-rays in the Irradiation Group.—A comparison has been made in the following table of the end results of the patients treated entirely by radium, entirely by X-rays or by a combination of the two agents.

TABLE VI.

Results in Primary Operable Cases Treated by Radium and X-rays.

Group	Number	Alive	%	Alive but Recurrent	Dead	Dead of Intercurrent Disease	Lost Track of
Radium	11	5	60	1	4	1 [5-yr. result]	0
X-rays	10 − 1 = 9	1	11	0	8	0	1
Combined (Radium and X-rays)	24 − 9 = 15	5	37	0	9	5 [one 5-yr. result]	5

Radium appears the more efficient agent of the two, and the best results were obtained where radium alone was employed. Our most satisfactory results followed the treatment of small tumors in old women, by the implantation of glass tubes into the tumor, implanting 1 to 1.5 millicuries to each cubic centimetre of tumor tissue to be treated.

The following case histories illustrate the efficacy of various types of irradiation used simply or in combination.

Primary Operable Group (Treated by Radium Alone)

CASE NO. 167.—L. S., aged forty-nine years, married, was admitted to the hospital on the service of Doctor Quick, May 9, 1919. She had never been pregnant. About May, 1917, a small, hard mass was discovered above the nipple in the right breast. The mass was painless and there was no increase in size until about eight months before admission. At this time she noticed occasional sharp pains in the region of the tumor.

Physical Examination.—The patient was in good general condition. In the right breast, above and to the outer side of the nipple, was a hard mass 3.5 x 2.5 cm., with moderate skin fixation, but movable on the chest wall. There was no nipple retraction and no axillary lymph-nodes were palpable. A chest plate was negative for pulmonary metastasis. The patient was examined by several of the attending surgeons and a diagnosis of carcinoma of the breast was made without reservation. No biopsy was taken.

On June 17, 1919, six bare tubes of radium emanation, totalling 16 millicuries, were implanted in the tumor, a dose of 2112 millicurie hours. A like number of tubes with a similar dosage was inserted in the right pectoral fold.

A marked erythema, over the treated areas followed, with superficial ulceration at one point. Three months after treatment no mass could be palpated. The patient remains free from disease, eight years after treatment.

Primary Operable Group (Treated by Radium and X-rays)

CASE No. 173.—C. S., aged forty-five years, a widow, of American parentage, was admitted on December 8, 1920. She had never been pregnant, and there had never been any history of trauma. In July, 1919, she noticed a retraction of the right nipple. At times she had experienced slight pain in and about this region.

Physical Examination.—She was a well-nourished woman. In the central portion of the right breast was an irregular, firm mass 11 x 11 centimetres with marked nipple retraction. There was slight skin fixation and the surface of the tumor was irregular. No nodes could be palpated. X-ray examination of the chest was negative for pulmonary metastasis.

Operation was advised, and a pre-operative cycle was given in December, 1920, consisting of four L. V. 1 treatments of the right breast and drainage areas. Upon reconsideration by the patient, she left the hospital, deciding that she would not undergo operation. Later, through correspondence, the patient returned and decided to submit to treatment of her mammary disease by irradiation.

Examination made October 1, 1921, showed that the mass in the breast was a little larger, with the nipple drawn upward and outward to a still greater degree. The nipple had almost disappeared and about it was a reddened irritated skin. There were no palpable nodes in the axilla.

On October 12, 1921, she received a cross-fire with two radium packs: 8129 millicurie hours over the inner side of the breast and 8072 millicurie hours over the outer side. The distance was 6 centimetres and the filtration, 0.5 millimetre of silver and 2 millimetres of lead. On November 19, 1921, platinum needles were inserted in the tumor, giving 156 millicurie hours for each needle. On April 2, 1922, she received 9025 millicurie hours, a radium pack at 6 centimetres being applied directly over the anterior surface of the breast. No biopsy was done.

There was considerable immediate regression in the tumor, following each irradiation. No subsequent treatment has been used. The patient is now without evidence of active disease, six years and five months after the beginning of treatment.

Six patients were treated by local removal of the mammary tumor, preceded and followed by irradiation. Three of these have survived the five-year period without recurrence. An abstract of the case history of one of the satisfactory results obtained by this method is appended.

Primary Operable Group (Treated by Pre-operative Irradiation, Local Excision and Post-operative Irradiation)

CASE No. 154.—W. O., colored woman, aged forty-six years, born in the United States, was admitted May, 1920. She was a widow and had had two lactations of nine months duration without unusual incident. Nine months prior to admission she noticed a small lump in the right breast. This was not painful but had steadily increased in size.

Physical Examination.—The patient, who was obese, had a marked degree of aortic insufficiency. Examination of the upper, middle segment of the right breast revealed a hard mass, 3 centimetres in diameter. The mass was sharply defined but was somewhat fixed to adjacent breast tissue. There was no evidence of skin adherence and no axillary lymph-nodes were palpable. A chest plate was negative for evidence of pulmonary metastases.

At first, the patient rejected any operation because of her cardiac disease. A cycle of X-rays, consisting of four treatments of L. V. 1 was given over the right breast and lymph drainage areas. She was finally persuaded to submit to a local removal of the mass. This was done under novocain anæsthesia on June 11, 1920, carrying this incision wide of the tumor through normal breast tissue. Doctor Ewing reported that the mass consisted of 4 cysts, each measuring 2 x 2 cm. The walls of the cysts were smooth and

the cavities contained slightly blood-tinged serum. Microscopic examination revealed an adenocarcinoma with abundant stroma, probably arising in a cyst.

On June 23, 1920, a radium pack, containing 2053 millicuries of radium, was applied for six hours over the site of operation.

In February, 1922, a small firm node was palpable in the right axilla and a similar one in the right supraclavicular region, just behind the inner end of the clavicle. There was no other evidence of recurrence. From February 2 to March 16, 1922, a cycle of 4 treatments of L. V. 2 X-rays was given, covering the right breast and drainage areas. The patient has remained well and free from disease to date, seven years after treatment was begun.

Primary Operable Group (Treated by L. V. 1 X-rays Alone)

Case No. 160.—O. R., aged fifty-seven years, married, of English parentage, was admitted to the hospital, May 29, 1920. She had had one lactation with a duration of five months without untoward incident. Two years prior to admission, she was operated upon for uterine myoma. At this time, two small lumps were noted in the upper, inner portion of the right breast. These had not increased in size, but, at times, the patient complained of slight pain and itching in this region.

Physical Examination.—The patient was well-nourished. In the upper, inner quadrant of the right breast was a horse-shoe shaped mass 5 x 3 centimetres. The surface was irregular and skin fixation was present. The nipple was retracted but there were no palpable axillary nodes. The chest plate was negative for metastasis.

Because of the slow growth of the tumor and the patient's willingness to submit to irradiation, the decision was made to treat the case entirely by irradiation, but to remove a section for microscopic study. From May 29 to June 9, 1920, four L. V. 1 treatments were given over the right breast and drainage areas. August 13, 1920, under novocain anæsthesia, a section was removed for histological examination. Doctor Ewing's pathological report showed the case to be one of carcinoma simplex. The wound healed by primary union.

From September 16 to October 11, 1920, five L. V. 1 treatments were given over the right breast and drainage areas and a similar series of treatments was given from November 12 to December 15, 1920. From February 24 to March 17, 1921, four similar treatments were repeated over the same areas. In February, 1921, seven months after admission, there was no evidence of disease in the breast. In July, 1922, two years and two months after treatment, rather diffuse telangiectases were visible over the right breast, and this condition has persisted and increased somewhat during the past few years. At the present time the patient is alive and well with no evidence of disease, seven years after the beginning of treatment.

Pre-operative Irradiation.—Pre-operative irradiation in the treatment of mammary cancer has not been approved, generally. The reasons given for this attitude are: (1) it necessitates a delay in surgical intervention; (2) irradiation hyperæmia may cause more active bleeding; (3) wound healing is less satisfactory; and finally, better end results are not obtained.

Following pre-operative X-ray treatment, we have preferred an interval of three or four weeks before operation was undertaken. This delay has seemed justified, because irradiated tumor cells are rendered less viable, and irradiated tissues in the operative field become unfavorable soil for the growth of cancer cells, left or disseminated at the time of operation.

With an interval of three to four weeks between the time of the last X-ray treatment and operation, it has been unusual to meet active or troublesome bleeding. However, if the interval is shorter and the dosage employed

has been heavy, more disturbing hemorrhage may be expected. It should be noted that this unpleasant incident has been encountered in numerous cases in which irradiation was never used.

It has been our impression that wound healing has not been delayed following the pre-operative treatment which we have employed.

A series of cases reported to this Association by Doctor Herendeen and the writer in 1925, strongly suggested that, where pre-operative irradiation had been used, a higher percentage of recoveries could be expected. Our conclusions were based upon three year results, for data over a longer period had not accumulated. The present article permits a comparison of five-year results in a series of cases, where pre-operative irradiation was employed or entirely omitted.

An inspection of Graph No. 1 shows that pre-operative irradiation has furnished a slightly higher percentage figure in five-year results than the groups in which preliminary irradiation was omitted. Upon the other hand, when Table IV is studied, it is evident that when pre-operative irradiation was used, the average duration of life after treatment was six months longer than in the purely surgical group, and six months shorter than those receiving only post-operative irradiation.

A review of the type of pre-operative X-ray treatment given reveals that in two-thirds of the patients the L. V. 1 technic was employed. Moreover, in a large proportion of the patients, the ideal interval of three to four weeks between irradiation and operation was not carried out. Frequently, one cycle of L. V. 1 X-rays, given in five to seven days, was followed, a few days later, by radical surgery. Today we know that such treatment is far less effectual as a pre-operative measure than the technic employed in more recent cases.

Post-operative Irradiation.—Less objection has been raised to the employment of post-operative irradiation than to the use of radiation, prior to surgery. None of the objections to pre-operative irradiation have seemed valid when post-operative irradiation was proposed. The writer has frequently outlined our reasons for employing post-operative irradiation routinely at the Memorial Hospital.

An inspection of Graph No. 1 shows that the patients in whom post-operative irradiation was used gave a percentage of five-year results which was much higher than in patients in whom this procedure was omitted. The five-year results, in the surgical post-operative group, shows 35 per cent. alive and well, whereas, in the purely surgical group, but 15 per cent. of recoveries was obtained. If we turn to Table IV, one will see that the duration of life after radical surgery alone was three years, while the duration in the post-operative irradiation group was four years and three months, representing a decided advantage in favor of post-operative treatment.

Moreover, we have usually confined the post-operative treatment to one or two cycles of four treatments each. More recently, we are giving three

or four such post-operative cycles, which makes the treatment additionally effective.

When we review the type of X-ray treatment given to our patients post-operatively, we find that two-thirds of them were treated by the L. V. 1 type of therapy, but this was frequently combined with the L. V. 2 technic. We believe that the post-operative irradiation, now in use at the Memorial Hospital, consisting of L. V. 2 or L. V. 3 types of treatment, for the two lower portions of the operated side, and high-voltage for the two upper areas, will give still better percentage figures.

OPERATIVE MORTALITY IN THE PRIMARY OPERABLE GROUP

In seventy-seven patients on whom radical operation was done at the Memorial Hospital there was but one operative death, the patient succumbing to pneumonia two weeks after operation. This is an operative mortality of 1.3 per cent.

PRIMARY INOPERABLE GROUP

In two previous communications by the writer, in one of which Doctor Herendeen was associated, the general management of primary inoperable cases and the methods of irradiation employed were fully discussed. Every worker in this field has felt that an evaluation of the efficacy of irradiation in primary inoperable cancer of the breast could never be satisfactorily made until trustworthy data could be obtained upon the duration of the disease in untreated cases. Recently, a very interesting study made by Daland of 100 untreated cases has furnished the much-desired information. We have compared his series with a group comprising 133 of our own primary inoperable cases, treated by irradiation, with or without palliative surgery, and the results are interesting. The following table compares the two groups with respect to the average age at onset and the average length of life.

TABLE VII.

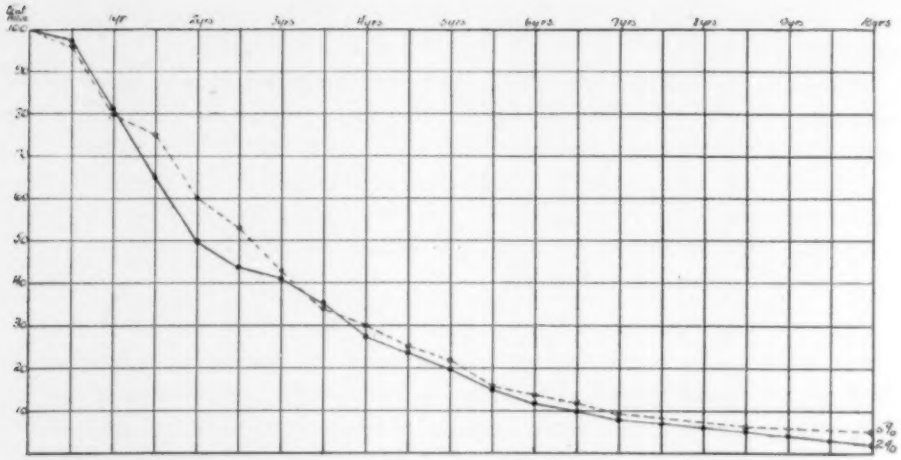
Age at Onset and Length of Life.

(Primary Inoperable Cases.)

	Untreated (Daland)	Treated (Present Series)
Average Age at Onset	57.5 years	53.1 years
Youngest Patient	31 years	30 years
Oldest Patient	87 years	85 years
Average Length of Life	40.5 months	44.6 months

The average total duration of disease in the untreated series was 40.5 months, while in our own cases, treated by irradiation, the corresponding figure was 44.6 months. The patients, on the average, lived four months longer, where irradiation was used, than did the untreated cases.

When the Daland curve is plotted, showing the percentage of patients alive, at six months intervals, for a period of ten years, and our own results are similarly plotted, the two curves are as follows:



GRAPH 2.—Duration of disease from onset in treated and untreated patients with primary inoperable mammary cancer. Primary inoperable untreated cases (Daland), 100 patients _ _ _ _ _ _ _. Primary inoperable treated cases, 133 patients _____.

An inspection of this graph shows that the two curves are closely comparable, the Daland curve giving a higher percentage alive at the end of ten years than was obtained in our own series, following treatment by irradiation.

One would conclude from a study of these two curves that irradiation is ineffective in altering the course of primary inoperable carcinoma of the breast. But such a conclusion is not fully justified. The major portion of the treatment was given prior to May, 1922, when our X-ray equipment was entirely low-voltage, and most of these patients received only the L. V. 1 type of treatment.

X-rays of this sort were more effective in dealing with superficial lesions, but the important extensions of the disease to the axilla, bones and viscera reacted less favorably to this type of therapy. At first, treatment was focused upon the palpable lesions, while many metastatic areas received scant irradiation.

The following table shows the age at the onset of disease, in the two series of cases.

TABLE VIII.

Age at Onset of Disease in Primary Inoperable Cases.

	Untreated Cases 100 Patients—Daland		Treated Cases 124 Patients Present Series	
Years	Number of Patients	Per cent. in Age Group	Number of Patients	Per cent. in Age Group
55 or over	59	59	51	41
40–55	38	38	52	42
Under 40	3	3	21	17

Inspection of this table reveals that but 3 per cent. of Daland's cases were in the age group in which highest malignancy is expected, whereas 17 per cent.

of our own were so classified. Fifty-nine per cent. of Daland's cases were fifty-five years or over, at which age the disease is relatively benign, but 41 per cent. of our patients falling into this most favorable group. This comparison shows that the untreated patients probably had less menacing forms of cancer than our own.

Furthermore, thirty-seven of our patients (30 per cent.) had an average duration of disease up to admission of four months, while sixty-nine (52 per cent.) had an average duration of ten months. It is evident that a large number had rapidly growing tumors, dissemination occurring early. Seven of the cases were of the fulminating inflammatory type and two were associated with pregnancy. Two were also afflicted with cancer elsewhere, one patient having a cancer of the uterus and the other, cancer of the ovary. Four of our primary inoperable cases, who are alive and well today, cannot be included for comparison, as they have not yet survived the ten-year period from the beginning of symptoms.

The benefit to be expected from the treatment of such patients are: relief from pain in the primary lesion and metastases to bone; healing of superficial carcinomatous ulcers; improvement in the patient's general condition; and, in some instances, a prolongation of life.

The rapidly fatal issue of a patient with a highly malignant tumor is illustrated in the following case history:

Case No. 254.—K. H., was an unmarried Irish woman, forty-six years of age at the time of her admission in June, 1921. Six weeks prior to admission she began to suffer neuralgic pains in the right arm, associated with a sense of tightening in this extremity. These symptoms persisted for about two weeks, and then she noticed a small lump in the lower portion of the right breast. This mass increased in size rapidly, up to the time of admission.

Physical Examination.—She was a poorly-nourished woman with the right breast completely replaced by a firm mass, 10 cm. in diameter. The nipple was retracted, fixed and œdematous. There was marked skin adherence and complete fixation to deeper structures. Palpation revealed a continuous mass of tumor tissue running upward from the breast into the right supraclavicular space and the right side of the neck. The circumference of the right arm, below the axilla, was 2.5 centimetres larger than the left. The left breast showed considerable induration and a firm node was palpable in the left axilla. An X-ray plate of the chest revealed evidence of some enlargement of the nodes in the right hilum, with carcinomatous infiltration, extending along the bronchi.

A cycle of X-ray treatments, consisting of four exposures of L. V. 1 type was given over the right side, from June 9 to June 13, 1921. Six similar treatments were given to both right and left sides, from July 12 to July 19.

The patient failed rapidly and she was confined to bed under Social Service care. She developed severe pain in her lumbar and pelvic region and a persistent cough. She died at home September 21, 1921. The total duration of disease from the beginning of symptoms was five months.

Four patients, in our Primary Inoperable Group, are now without evidence of disease. History and treatment of one of these patients are abstracted below.

Primary Inoperable Group

CASE No. 306.—A. S., a widow, of Italian parentage, aged sixty-five years, was admitted to the breast clinic, July 14, 1919. She had had four lactations, the last one in 1893, the duration of each being 18 months. Twenty-nine years before admission, an abscess in the right breast was opened and drained. Seven months prior to admission she noticed a small lump in the upper, outer portion of the right breast. The breast itself, increased in size and for two months had been tender and painful.

Physical examination showed a woman in fair nutrition. There was a mass 7 x 7 centimetres in the upper, outer quadrant of the right breast. The nipple was retracted and somewhat fixed. The skin overlying the tumor was reddened and the breast was partially adherent to the chest wall. Several enlarged, hard nodes could be felt in the right axilla.

From July to December, 1919, the patient was treated by L. V. 1 type of X-ray therapy, receiving, altogether, 19 treatments over the right breast and lymph-drainage areas. In January, 1920, ulceration of the overlying skin occurred. A palliative mastectomy was done, January 15, 1920, dissection being carried down to the fascia overlying the pectoralis muscle. The wound was partially closed by sutures. Three weeks later the unhealed area was covered with pinch grafts, which took well and healed rapidly. Pathological examination of the specimen by Doctor Ewing showed a cellular carcinoma with very extensive vascular hydropic degeneration throughout the tumor. In October, 1920, an L. V. 1 cycle was used over the right breast and drainage areas and this was repeated in December of the same year.

There has been no subsequent treatment and the patient is alive and well, seven years and ten months after admission.

PATHOLOGICAL HISTOLOGY

Sections were obtained in seventy-three of the primary inoperable patients, or 55 per cent. The pathological types encountered are indicated in the following table:

Primary Inoperable Cases

Carcinoma	Simplex	29
	alveolar	9
	fibro	13
	sweat gland type	3
Adenocarcinoma		7
	cellular	2
	mucous	2
	papillary cyst	1
	sweat gland type	2
Carcinoma—type not stated		5
		73

CONCLUSIONS

1. The treatment of carcinoma of the breast by irradiation methods, alone or combined with radical surgery, gives a higher percentage of good five-year results, than when radical surgery alone is employed.

2. Pre-operative irradiation adds to the percentage figures of satisfactory five-year results. High-voltage treatment should be employed, permitting an interval of three to four weeks between treatment and operation. Carried

out in this way, bleeding at operation is not more active and wound healing is not delayed.

3. Post-operative irradiation has increased the length of life after operation and has yielded a higher percentage of satisfactory five-year results, than when radical surgery alone was employed.

4. Radium is a more effective agent than Röntgen-rays in dealing with this disease.

5. Convincing evidence of the efficacy of physical agents in dealing with mammary cancer is furnished; first, clinically, by marked diminution in size or complete disappearance of the tumor, and second, by the gross and microscopical changes occurring in tumor tissue adequately irradiated.

6. Although the Daland curve and our own are identical, a comparison of the two groups shows that our own primary inoperable cases were younger women and that more than 50 per cent. of them had rapidly growing tumors, the cases becoming inoperable ten months from the onset.

7. Treatment of primary inoperable cancer of the breast by radiation gives relief from pain, healing of superficial carcinomatous ulcers, improvement in general condition and prolongation of life.

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GASTROSTOMY IN CARCINOMA OF THE ŒSOPHAGUS *

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One of the most tragic and discouraging consultations referred to the surgeon is cancer of the œsophagus. In 1914, Chevalier Jackson [1] stated that the mortality of malignant diseases of the œsophagus was at that time 100 per cent. Eleven years later Jackson [2] reiterates, "malignant diseases of the œsophagus with its 100 per cent. mortality is one of the greatest reproaches to surgery today. In almost all other fields at least a few cases are cured." Today, he may still repeat the above with justification.

Cancer of the œsophagus is not a rare disease: only uterine, mammary, and gastric malignancy exceed it in frequency in the general cancer incidence. In England and Wales there were 15,909 deaths from this cause during the ten years, 1911–1920 (Souttar).[3] Clayton,[4] in analysing 5900 autopsies performed in the past five years at the Philadelphia General Hospital, found 812 cases of malignancy, and of these, 41 (5.05 per cent.) died of carcinoma of the œsophagus. Vinson [5] reports 154 cases studied at the Mayo Clinic in two years. In a group of 600 cases of carcinoma of the gastro-intestinal tract studied by Friedenwald, Zinn, and Feldman,[6] 128 (21.3 per cent.) were of the œsophagus. These facts bring out forcibly the importance of Jackson's statements.

Until rather recently nearly every writer on the subject of œsophageal cancer has advocated gastrostomy for inoperable cases, and practically, this has meant nearly all. Chr. A. Egeberg,[7] a Norwegian surgeon, was apparently the first (1837) to advocate gastrostomy in the cases of stricture and diverticulum of the œsophagus. The operation was performed on animals by Bassow in Russia in 1842, and by Blondlot in France in 1843, for the purpose of studying the physiology of digestion (Senn).[8] Sedillot [8] in 1849 first performed the operation on a human being and it was by him that the term gastrostomy was coined. There then followed twenty-eight successive deaths before the first successful case was performed in 1875 by Sidney Jones.[10] This case lived forty days and was for carcinoma of the œsophagus. This success was shortly followed by Verneuil's [11] case in 1876. By 1884 Gross [9] was able to collect 207 cases of gastrostomy, 167 of which were for cancer of the œsophagus, and of these 117 (70 per cent.) died in one month and 81 per cent. in three months. One case lived twelve months and one case thirteen months. In 1897, John Ashhurst [12] collected 189 additional cases with a mortality of 51.7 per cent.

* Read before the joint meeting of the Philadelphia and New York Academy of Surgery, February 8, 1928.

Ashhurst opposed the operation in malignant disease, believing that the risk was so great and the possibility of gain so slight as not to recommend it. Earlier, Gross [9] favored it at an early stage of carcinoma but says, "its adoption on the other hand, when death is imminent from exhaustion and starvation, is a species of refined cruelty reflecting no credit on surgery." Through the years the same trend of thought prevailed, one technical method succeeding another until the advocates of radium and intubation appeared.

Dilatation by sound and bougies of œsophageal strictures, whether carcinomatous or not was the usual method of treatment before the days of gastrostomy. Probably the foremost advocate of this type of treatment at present is Vinson of the Mayo Clinic. In 1923 [5] he reported 125 cases of carcinoma of the œsophagus, treated by this method with three deaths and an average duration of life of five months. The diagnosis in these cases presumably was made on the history, the passage of sounds and X-ray, since he states that, "œsophagoscopy is of limited value in diagnosis and treatment." We agree with Jackson [2] when he says, "there are only two means by which an early diagnosis of œsophageal malignancy can be made, namely, (1) Röntgen-ray examination and (2) œsophagoscopy. All other means are late, inconclusive and some of them dangerous." Presumably also Vinson's cases were somewhat selected since both in this paper and in 1925 [13] he lists certain types that are unsuitable for this procedure and for which he recommends gastrostomy. This is important in considering mortality figures and average length of life.

The advocates of radium used by itself have apparently decreased in recent years. Stone [14] at the Memorial Hospital, New York, did not find a single case that can be said to have been cured by radium although there was some temporary improvement in many of the cases. In the discussion that followed Hedblom, Case, Meyer, and Heyd were equally pessimistic. Wassink [15] reports one case in forty-one living two and one-half years after application. Guisez,[16] who has had extensive experience in the use of radium, reports a case of a man, aged sixty, who reported to him in November, 1911, with the history of six months difficulty in swallowing. Œsophagoscopy showed what was apparently a malignant growth the size of a five franc piece, a few centimetres above the cardia. Biopsy diagnosis was epithelioma. This man had several applications of radium and in January, 1926, then seventy-five years of age, was apparently well and had no more difficulty in swallowing.

Intubation, of necessity, entails previous dilatation in most cases. Souttar [3] in reporting 100 cases of œsophageal carcinoma gives results as follows: in fifty cases of intubation he had seven deaths (14 per cent.) and average duration of life in twenty-six followed cases of 5.3 months. In twenty cases of gastrostomy he had seven deaths (35 per cent.) with an average duration of life in ten followed cases of 3.6 months. In his seven immediate deaths following intubation the œsophagus was torn in one and perforated in another. In one case he had to give up his intubation due to hemorrhage from the growth during manipulation. In some cases the stricture was

impassable and could not be intubated. In at least one case growth was too high for intubation, and in several cases the tube had to be replaced. In general, in looking over his table of cases, one gets the definite impression that his gastrostomy cases were much the worse risks and would not be expected to survive any procedure as well as his intubation cases. Myerson [17] another advocate of the intubation method reports four of his cases one of whom lived sixty-nine days, another twenty-nine days, a third still living at the time of his report, and the fourth 117 days.

In this clinic we have practised gastrostomy almost routinely. In view of the great difference in the immediate mortality of the other palliative measures as briefly reviewed above and gastrostomy, it seemed to us worthwhile to stop and consider. Our series is admittedly small but completely studied and with one hundred per cent. follow-up. Our study did not cause us to alter our method of treatment for reasons we will bring out. The above facts are our only excuse for adding to the immense literature on this subject.

During the period September 1, 1922 to January 15, 1928, there were a total of thirty-six cases of gastrostomy done on Division B with ten deaths, a mortality of 27.8 per cent. Of these twenty-one were for carcinoma of the œsophagus with six deaths, a mortality of 28.5 per cent.

TABLE I.

Gastrostomy Cases, Division B

September 1, 1922–January 15, 1928

	Cases	Deaths	Mortality
Carcinoma œsophagus	21	6	28.5
Carcinoma fundus	2	0	
Stricture œsophagus	7	2	
Carcinoma cheek	1	0	
Sarcoma mediastinum	1	1	
"Vicious circle" post-operative....	1	1	
Carcinoma pharynx	1	0	
Carcinoma larynx	1	0	
Larnygeal paralysis	1	0	
	36	10	27.8

A glance at Table I discloses the fact that the gastrostomy mortality for the total series is essentially the same as in the cancer series. Therefore, it may be assumed that the carcinoma of itself is not the chief feature in the high mortality but extraneous conditions. For example—in our non-cancer series we had two deaths in strictures. One was due to the fact that, after the patient left our service, the gastrostomy tube was cut off and the proximal portion allowed to fall in the stomach in the belief that this would be passed. Instead of this, the tube plugged the pylorus and the child died of acute dilatation of the stomach. The other case was a man in very bad condition, with myocarditis, hypertrophied prostate and B U N of 88, who died from his cardio-vasculo-renal disease. The other two cases are self-explanatory in the table.

TABLE II.

Gastrostomy, Division B

Hospital Deaths—Carcinoma Œsophagus

Hospital No.	Case	Lived	
495	I	2 days	Œsophageo–tracheal fistula
7399	VI	5 "	Œsophageo–tracheal fistula
833	II	15 "	Autopsy. Perforation œsophagus
4588½	IV	16 "	Œsophagus exposed in neck at same time
5066	V	21 "	Œsophagectomy 19 days later
1126	III	24 "	Leakage. Jejunostomy 16 days later

The following is a brief summary of the record of the fatal cases:

CASE I.—No. 495. Male, age fifty-three. Admitted to the Medical Service November 22, 1922, with a six months' history of increasing dysphagia and marked loss of weight. He had cough with profuse foul sputum. An X-ray showed œsophageo-tracheal fistula. The leucocyte count 19,100. He was transferred to the surgical service November 28, 1922, and gastrostomy under local anæsthesia done that day. The lungs filled up and death occurred November 30, 1922. The autopsy showed a large carcinoma of the œsophagus, just below the bifurcation of the trachea with perforation of the left bronchus, with metastases to the liver, pancreas, and abdominal lymph-nodes. The left lung showed gangrene and cavitation. Microscopic section showed a squamous carcinoma, grade 4.

CASE II.—No. 822. Male, age fifty-eight. Admitted to Bronchoscopic Service January 15, 1923, with a note that he lost twenty-seven pounds in the past three months. No other history. X-ray January 18 showed obstruction in the lower and middle third. Œsophagoscopy showed ulceration of the thoracic œsophagus, 4 centimetres above the diaphragm. The full extent of involvement below was not explored. Biopsy specimen showed squamous carcinoma, grade 3. He was transferred to Surgical Service January 25, 1923, gastrostomy done on the same day. Died February 7, 1923, and autopsy showed an acute peritonitis, apparently from perforation but no metastases. Autopsy specimen also showed squamous carcinoma, grade 3.

CASE III.—No. 1126. Male, age fifty-five. Admitted to Surgical Service March 12, 1923, with a history of dysphagia dating back to June, 1922. July 1, 1922, constriction shown by X-ray. July 24, 1922, œsophagoscopy by Doctor Jackson showed narrowing of the lumen lower third and hard projecting white mass on the anterior wall. Biopsy—squamous carcinoma, grade 2. Dysphagia for solids continued but did not increase, and there was only moderate loss of weight. A few days before admission dysphagia became absolute. Gastrostomy March 13, 1923, under local and gas anæsthesia. Owing to defect in gastrostomy technic, much leakage occurred. Weakness developed and death occurred April 6, 1923—twenty-four days after operation. No autopsy.

CASE IV.—No. 4588½. Male, age sixty-two. Admitted to the Surgical Service November 10, 1924. One year previously had substernal pain and "sticking" of food. Dysphagia increased. In September, 1924, had operation for gall-bladder in another hospital. Aphonia developed about one month later and dysphagia increased. Loss of weight sixty pounds. X-ray showed constriction lower end of the œsophagus. Œsophagoscopy showed an ulcerating, fungating mass 36 centimetres from the upper teeth that seemed to surround completely the œsophageal lumen. Biopsy showed squamous carcinoma, grade 2. Slight irregular fever each day. Gastrostomy November 15, 1923, under gas ether anæsthesia. Œsophagus explored in neck and iodoform gauze passed beneath it. An excision of the œsophagus was intended later. Gastrostomy worked well but fever continued, and patient became irrational. Blood transfusion November 20, 1924. Pulmonary œdema developed and death occurred December 1, 1924, sixteen days after operation. Autopsy showed annular constriction of the œsophagus a short distance above the diaphragm. An ulcerative area about 3 centimetres in

width extended almost through the wall of the œsophagus, which ruptured when traction was put on it. No metastases. Lungs showed emphysema and œdema of the lungs, kidneys arteriosclerotic, and pericardium showed acute fibrinous pericarditis.

Case V.—No. 5066. Male, age fifty-one. Transferred from Medical Service January 23, 1925. Dysphagia of one year duration. Dull substernal pain. X-ray showed partial obstruction in thoracic œsophagus at the level of the third thoracic vertebra. Œsophagoscopy showed an area of infiltration that projected forward from the posterior œsophageal wall in a thick fold 25 centimetres from the upper teeth. Biopsy showed squamous carcinoma. Patient in good condition, gastrostomy January 24, 1925, under local and gas. Recovery uneventful and patient did well. Excision of the œsophagous February 12, 1925, Torek method. Death February 15, 1925—sixty hours after second operation and twenty-one days after gastrostomy. Autopsy specimen showed squamous carcinoma, grade 3.

Case VI.—No. 7399. Male, age sixty-eight. Admitted to Bronchoscopic Service October 15, 1925, with a story of six weeks difficulty in swallowing and at the time of admission was unable to swallow without severe, violent coughing attacks, in which he brings up the substance swallowed. Diagnosis of carcinoma of the œsophagus which had perforated into the trachea made and gastrostomy done immediately under local anæsthesia. His condition never warranted œsophagoscopy. He died following an attack of vomiting with pulmonary aspiration on morning of October 20, 1925. Partial autopsy obtained and diagnosis verified but record lost.

Comment.—Of these six deaths, two should be charged against œsophagectomy since undoubtedly the operations on the œsophagus caused the death and not gastrostomy. The two cases that had œsophageo-tracheal fistulæ would have died under any method of treatment. No. 822, Case II again would have died under any method of treatment, since the lesion perforated. We wish to point out that in this series where gastrostomy was done without selection of cases, the high mortality is due, in part at least, to the fact that, certain cases that would have died under any method of treatment (excluding the œsophagectomies), as for example the œsophageo-tracheal fistulæ, are barred from other palliative methods. We believe that a simple gastrostomy in a similarly selected group of cases should be practically as safe as other methods of treatment.

Table III.

Gastrostomy Division B. Recovered Cases
Carcinoma Œsophagus

Cases that lived less than 6 months

Hospital No.	Case	Lived	
5052	VII	20 days	Emergency operation
8618	VIII	26 "	Marked anemia
4652	IX	30 "	Marked aphonia
2381	X	52 "	Died—œsophagectomy
5073	XI	73 "	Died—Pneumonia
4875	XII	100 "	Probable lung metastases—(X-ray)
5339	XIII	136 "	Abscess lung (X-ray)

Case VII.—No. 5052. Male, age forty, who had only two months symptoms and was admitted on the evening of February 7, 1925, in extremis. He was operated upon that night as an acute emergency and therefore had no X-ray or œsophagoscopy. He improved somewhat after his operation but died at home February 27, 1925, twenty days after his operation.

Case VIII.—No. 8616, was a man of fifty-eight years, who had had symptoms for

one year and was greatly emaciated and in precarious condition. Complete dysphagia. Hæmoglobin 30 per cent. X-ray elsewhere showed complete obstruction of the œsophagus. Due to his condition he was operated on immediately without any further studies. He improved definitely after operation, gained in weight, so that he was able to go home, but then went rapidly downhill and died twenty-six days after operation.

CASE IX.—No. 4652. Male, sixty-one years. Symptoms thirteen months. Aphonia five months. Marked loss in weight. Achylia. X-ray showed lesion involving lower two or three inches of œsophagus. Biopsy by œsophagoscopy adeno-carcinoma, grade 2. Gastrostomy October 30, 1924, under local. Patient's general condition improved, gained in weight and strength but aphonia increased. Died at home November 30, 1924.

CASE X.—No. 2381. Male forty-eight. Symptoms one month. Admitted November 10, 1923, in good condition. X-ray—obstruction lower end of the œsophagus just above diaphragm. Œsophagoscopy showed fungating ulcerating mass 34 centimetres from upper alveolus. Biopsy—squamous carcinoma. Gastrostomy and thoracotomy November 17, 1923. Patient did very well. Improved and returned for œsophagectomy. Died following œsophagectomy January 8, 1924, fifty-two days after gastrostomy. Specimen showed squamous carcinoma, grade 2.

CASE XI.—No. 5073. Male, forty, with five months symptoms. X-ray partial obstruction—lower thoracic. Œsophagoscopy fungating mass 35 centimetres from upper teeth. Biopsy—squamous carcinoma, grade 4. Improved temporarily. Died seventy-three days after operation of what was said to be pneumonia.

CASE XII.—No. 4875. Male, fifty-eight. Symptoms of two months. Loss of weight, fair condition. X-ray showed stricture upper thoracic œsophagus and diagnosis confirmed by œsophagoscopy post-operatively. Slide lost. X-ray of chest and physical examination showed probable lung metastases. Patient continued to lose weight despite gastrostomy and died about 100 days after operation.

CASE XIII.—No. 5339. Male, thirty-four. Six months symptoms. Emaciated. X-ray—obstruction mid-thoracic œsophagus. Chest X-ray showed lung abscess with considerable cavitation. Œsophageo-tracheal fistula could not be demonstrated. Œsophagoscopy before operation could not be done because of a constriction at the level of the crico-pharyngeal fold. Retrograde œsophagoscopy post-operatively showed marked induration in fungating mass mid-thoracic œsophagus. Biopsy squamous carcinoma, grade 4. After gastrostomy patient improved and was sent home. He died 136 days after operation apparently from his pulmonary condition.

Comment.—In this group, again, the patients were in wretched condition to begin with. In Case VII (No. 5052) gastrostomy had to be done immediately or allow the patient to die without any treatment. Any other palliative treatment was out of the question. Case IX together with Case IV in Table I showed a marked aphonia. This seems to be a bad prognostic sign.

TABLE IV.

Gastrostomy Division B. Recovered Cases
Carcinoma Œsophagus
Cases that lived over six months

Hospital No.	Case	Lived	
4604	XIV	204 days	
4224	XV	270 "	Onset slow. 3 months previously diagnosed ulcer
1181	XVI	305 "	Radium used 18 days later
10212	XVII	350 "	
3242	XVIII	360 "	Died suddenly while fairly well
4276	XIX	392 "	Good for 9 months

CASE XIV.—Was living 204 days post-operatively but in a rather precarious condition due to bilateral recurrent paralysis which interfered with his cough mechanism. He died probably shortly after this as these people do from drowning in their own secretions.

CASE XVI.—No. 1181. Had an application of radium eighteen days after gastrostomy.

CASE XIX.—No. 4276. Was perfectly comfortable and happy for nine months and gained weight. He then began to have pain in his back and chest and some hæmatemesis.

Two cases are still living at the time of this report. One, No. 11695, is living 142 days after his operation. The gastrostomy is working perfectly but he complains of pain in his back and legs. The other, No. 12371, is still living seventy-one days after his operation and is about to return for œsophagectomy.

Discussion.—In this series we have twenty-one cases of proved carcinoma of the œsophagus on whom gastrostomy was done with six deaths, a mortality of 28.5 per cent. This does not compare favorably with Vinson's figures of 125 cases treated by dilatation and bouginage with only three deaths, nor with Souttar's series of fifty cases treated by the intubation method with seven deaths (14 per cent.). However, if we excluded the two cases where we manipulated the œsophagus and the two cases of œsophageo-tracheal fistulæ, which are barred from the other treatment, we have seventeen cases of gastrostomy with two deaths, a mortality of 11.8 per cent.

Fifteen cases survived the operation, two are still living and the remainder had an average duration of life of six months. Vinson reports average duration of life of five months and Souttar's followed-cases average duration of life of five and three-tenths months. If we excluded Case VII an acute emergency which could not have been treated by other methods, and Case X, the œsophagectomy case, it gives us eleven cases and average duration of life of seven months. Of these eleven cases, six survived over six months, the longest being thirteen months.

The objections to gastrostomy have been the high primary mortality, the increased length of stay in the hospital, and the objection of the patient to being fed through the gastrostomy tube. We believe that we have partially explained the high mortality. The increased length of stay in the hospital should not be considered if we can obtain better results. Discomfort to the patient in regard to feeding cannot be avoided. The objections to dilatation and bouginage have been well summarized by Jackson.[2, 18] The fact that Vinson has had so few complications does not mean that, if this method became popular, everyone would be as successful, as is shown in the report of Friedenwald and Morrison.[19] The advantage of the other methods, of allowing the patient to swallow, is sometimes only temporary. At times, following gastrostomy, as many have pointed out, the œsophagus after some rest will again allow liquids and soft foods to go by.

When we consider the effect on the lesion itself there can be no question of the superiority of gastrostomy over dilatation or intubation methods. Our Bronchoscopic Service has frequently seen marked improvement in the local

lesion following the rest that is given to the œsophagus, and, what is perhaps most important, the gastrostomy allows us, if the condition of the patient warrants it, at a later date to attempt a radical removal, admittedly the patient's only chance for cure of his lesion.

The statistics of this small series may be of interest. The ages vary from thirty-nine years to sixty-eight years of age, an average of fifty-three and eight-tenth years. They were all males. Three of the six patients over sixty years of age died in the hospital but none of the six under fifty. With one or two exceptions the dysphagia was of long duration and only twice did the condition of the patient warrant proceeding with œsophagectomy. Evidently Jackson's[2] statements should be broadcasted. He says that asphyxia, dysphagia, pain, weight lost, hæmatemesis, emaciation, and cachexia are all hopelessly late symptoms. Every patient mentioning the slightest abnormality in swallowing, or even slight abnormal sensation in the cervical, retrosternal or epigastric region should be considered possibly cancerous and examination with X-ray and œsophagoscopy urged.

By X-ray or œsophagoscopy the lesion was located in the upper third in three cases, in the middle third in seven cases and the lower third in nine cases. All the slides were recently reviewed and graded by Dr. A. E. Bothe, according to Broder's classification. Of fifteen cases reviewed twelve were squamous cancer, and three adeno-carcinoma; the adeno-carcinomas all being in the lower end of the œsophagus. Seven were grade 2, three grade 3, five grade 4. The average total duration of life was for the grade 2, seventeen months; grade 3, eight and one-quarter months, and one still living; grade 4, ten months. Clayton[4] found of thirty-nine cases studied, three of grade 1, with an average duration of life sixteen months and one of which had extensive metastases; fifteen cases grade 2, duration eight months, five cases with extensive metastases; twelve cases grade 3, duration five months, five cases with extensive metastases; and nine cases grade 4 duration three and one-half months, all with extensive metastases. It seems as if this grading may be of some value in selecting the case for œsophagectomy.

SUMMARY

1. An analysis of twenty-one cases of gastrostomy for proved carcinoma of the œsophagus is presented.

2. The hospital mortality was 28.5 per cent. If the œsophagectomies and those that could not have been treated by other palliative methods are eliminated the primary mortality was 11.8 per cent.

3. The average duration of life of the cases that survived was six months, with two still living. If the œsophagectomies and those that could not be treated by other palliative methods are eliminated, the average duration of life was seven months.

4. The patients were all males with an average age of fifty-three and eight-tenths years. Only twice did the condition of the patient warrant proceeding with œsophagectomy.

5. The grading of the biopsies with Broder's classification may be of some value in selecting cases for œsophagectomy.

SUMMARY OF CASES

Hosp. No.	Sex and age	Duration	X-ray	Œsophagoscopy	Survival days	Remarks
495 F.S.	M. 53	6 mos.	œsoph. trach. fistula	none	2	Autopsy—sq. ca. grade 4 with exten. metastases.
822 E.B.	M. 58	3 mos.	obstr. lower third	ulcer 4 cm. abov. diaph.	13	Autopsy—sq. ca. grade 3, no met.
1126 R.M.B.	M. 55	9 mos.	obst. 8 & 9 thor.	strict. low. third	24	Biopsy sq. ca. grade 2.
4588½ H.W.	M. 62	1 yr.	constr. lower end	ulcer 36 cm.	16	Autopsy—sq. ca. grade 2, no met. œsoph. exposed in neck.
5066 J.F.	M. 51	1 yr.	obstr. third thor.	lesion 25 cm.	21	Excision œsoph. 19 days after gastrostomy. Spec. sq. ca. grade 3.
7399 M.S.	M. 68	6 wks.	none	none	5	Œsoph. trach. fistula—autopsy record lost.
5052 J.S.	M. 40	2 mos.	none	none	20	Pt. in extremis. Emergency op.
8618 C.M.	M. 58	1 yr.	outside	none	26	Hæmoglobin 30 per cent. Precarious cond. Operated immediately.
4652 C.G.	M. 61	1 yr.	3″ from cardia.	lesion lower end œsoph.	30	Biopsy, adeno-carc. grade 2.
2381 T.V.	M. 48	1 mon.	obstr. lower end	fungating mass, 34 cm.	53	Œsophagectomy.
5073 S.K.	M. 40	5 mos.	obstr. lower thoracic	fungating mass, 35 cm.	73	Died of pneumonia.
4875 J.D.	M. 58	2 mos.	strict. upper thoracic	yes	100	Specimen lost. Unimproved by gastrostomy.
5339 J.U.	M. 39	6 mos.	mid-thor. abs. rt. lung	retrograde	136	Constriction at crico-pharyngeal fold. Biopsy—sq. ca. grade 4.
4604 J.D.	M. 64	11 mos.	Comp. obstr. upper third	Infiltration 25 cm.	204	Bilateral recur. paralysis.
4224 S.F.	M. 64	8 mos.	obstr. third thoracic	stenosis mid. third	270	Slide lost.
1:81 L.S.	M. 57	2½ mos.	obstr. third rib	fungating ulcer, up. end.	305	Sq. ca. grade 3, one radium appl. 18 days post-gastrostomy.
10212 I.K.	M. 42	2 yrs.	2″ above diaphragm	fungating mass, 34 cm.	350	Adeno-ca. grade 2, post-op. atalectasis both lower lobes.
3242 C.N.	M. 59	6 mos.	obstr. first thoracic	large ca. cervical	360	Sq. ca. grade 4. Died suddenly while fairly well.

SUMMARY OF CASES—*Continued*

Hosp. No.	Sex and age	Duration	X-ray	Œsophagoscopy	Survival days	Remarks
4276 H.S.	M. 53	4½ mos.	obstr. mid-thoracic	fungating mass, 30 cm.	392	Sq. ca. grade 2. Happy for 9 mos.
11695 W.C.	M. 59	3 mos.	obstr. middle third	none		Still living after 142 days.
12371 J.P.	M. 40	2 mos.	obstr. lower third	fungating mass, 38 cm.		Still living after 71 days, returning for œsophagectomy.

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OPERATIVE RELIEF OF CARDIOSPASM WHERE DILATATION HAS FAILED*

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It has been shown by Plummer [1] and Vinson and their co-workers at the Mayo Clinic that only a small percentage of cardiospasm cases fail to respond to dilatation when the hydrostatic dilator can be passed through the cardia. There are certain cases, fortunately few in number, where the most expert are unable to pass the cardia even with the aid of modern armamentarium, and the assistance of surgery by the transgastric route for primary dilatation is necessary before hydrostatic dilatation can be carried out. There is also a certain percentage that recur within six months after dilatation. These excepted cases should be amenable to the operative procedure to be described.

Fig. 1.—Barium filled, dilated œsophagus before operation.

While the real etiological factors in cardiospasm are uncertain and confusing, the diagnosis of this condition has been simplified by the use of the X-ray and the opaque meal, but judging from the many transabdominal procedures still advocated for relief of these cases, it is evident that the surgical methods in use are not entirely satisfactory.

The operative procedures heretofore recommended include the different forms of cardioplastics, all requiring a free opening in the stomach and consequent liability to infection, even when the cardia is accessible without turning

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up the costal margin. Extramucous cardioplasty although minimizing the dangers of infection is not always practicable in a long, narrow thorax, without displacement of the costal margin. Plications of the œsophagus in the mediastinum have been advocated by Willy Meyer [2] and Reisinger,[3] but have not been successful. Invagination to produce shortening of the œsophagus within the mediastinum through an external exposure at the base of the neck has been used with success by Freeman.[4] The literature contains numerous ingenious transabdominal procedures for enlarging the cardia, which includes the application of mechanical force, either with protected forceps or the fingers as in Mikulicz's operation. As an opening in the stomach is always necessary for these procedures, the possibility of infection cannot be eliminated.

FIG. 2.—Barium retention in œsophagus six hours after meal.

Whether the immediate relief obtained by the patient in this case was due to the division of the constricted area or to the straightening out of the elongated, convoluted œsophagus cannot be definitely determined, but judging from the reports of the radiologist, the satisfactory clinical outcome and the local œsophageal changes reported by the œsophagoscopist it is presumed that either or both procedures have a field of usefulness in the treatment of those cases that fail to respond to the nonoperative type of treatment.

CASE REPORT.—J. R. M., age thirty-five, white, unmarried, American male, veteran of the World War and a former member of the United States Marine Corps, was admitted to the Walter Reed General Hospital, August 1, 1927. He complained of pain and distress beneath the lower end of the sternum after eating, accompanied by a choking sensation and regurgitation of the food swallowed. He also complained of weakness, inability to gain weight, and a mild constipation.

The patient stated that he was always in good health until the winter of 1924, while he was still in the Marine Corps, when he began to experience sharp, stabbing pains beneath the lower end of the sternum coming on suddenly, immediately after meals. These attacks occurred irregularly at first and lasted from five to ten minutes. There was no vomiting and the symptoms were not relieved by either food or alkalies. He slowly lost

weight and grew progressively weaker. After four or five weeks, he sought dispensary treatment and was sent to hospital where he remained nearly five months. During this time he had a constant feeling of weight beneath the sternum and occasionally vomited. He gradually reached the point where he was hardly able to swallow his food. After he was returned to duty he became a cook and in this position he was able to prepare special foods for himself and take plenty of time to eat. Under this régime he managed to get along fairly well. During 1926, he was again hospitalized and operated upon in January, 1927, for bilateral inguinal hernia. By this time he swallowed only with great difficulty, either liquid or solid food and he had lost considerable weight, being reduced to 110 pounds from previous weight of 140, his best weight at the beginning of his illness. As he was considered unfit for further duty with the Marine Corps, he was discharged from the service in June, 1927, as a result of a medical survey.

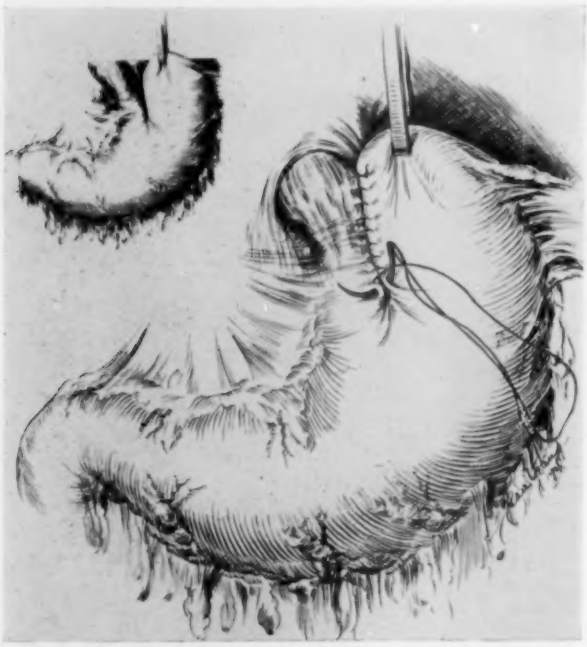

FIG. 3.—Posterior sutures in place.

At the time of his admission to Walter Reed the patient was ambulatory and afebrile. He appeared physically inferior, was poorly nourished, with dull, worn facies and exhibited a visceroptotic habitus. He was 67½ inches in height and weighed 113 pounds without clothing. The tonsils were atrophic and he had periodontoclasia with alveolar resorption of all his teeth. His chest was narrow, shoulders sloping and expansion poor. The manubrium was prominent, the lower end of the sternum depressed and the intercostal angle acute. On auscultation of his heart, an occasional extrasystole was heard and his blood pressure taken while seated was only 110 millimetres for the systolic with a diastolic of 70. The abdominal wall was thin and sagging, and he had marked visceroptosis. There were no masses nor any tenderness detected. He had a right, recurrent, indirect, incomplete, inguinal hernia and the right testicle was atrophic and soft. The liver and spleen were not enlarged. The patient appeared mentally dull and his response was slow. The muscles were generally soft and lacked development, and he had second degree flat feet.

X-ray examination of the gastro-intestinal tract showed an obstruction of the lower end of the œsophagus, with marked dilatation of the œsophagus above the obstruction. The barium filled œsophagus was 6.5 centimetres in width, regular in outline and ended at the hiatus in a smooth, cone-shaped shadow as shown in Figure 1. Six hours after the meal the œsophagus contained about one-third of the barium ingested, as in Figure 2, and at this time the stomach was empty and all the barium which had passed through the intestines was concentrated in the cæcum. None of the barium remained in the œsophagus twenty-four hours after the meal. Examination of the chest showed an irregular, calcified, paratracheal lymph-node on the right side and there was no evidence of a mediastinal growth. Normal response followed the intravenous administration of tetraiodophenolphthalein-sodium salt.

Œsophagoscopy showed a roughened, hobnailed, macerated area which bled easily, 23 centimetres from the upper incisor teeth or at about the level of the arch of the aorta. Below this point the œsophagus was distended into a sausage-shaped pouch, the mucosa was thickened and macerated and a little turbid fluid was present. The œsophagoscope was advanced with difficulty by raising shoulders and flexing the head. At the forty-sixth centimetre level the bottom of the pouch was reached, but the examining instrument could not be introduced through the narrowed orifice into the cardia of the stomach.

Examination of the blood showed a coagulation time of four minutes, 90 per cent. hæmoglobin and 13,500 leucocytes, the polymorphonuclear cells amounting to 63 per cent. The Wassermann reaction and Kahn test were negative.

The tonsils were removed under local anæsthesia, August 25, 1927. The patient received belladonna constantly in one cubic centimetre doses, three times daily before meals for three months and bromides intermittently, with little or no benefit.

On October 15, 1927, the œsophagus was dilated to 55 F (.17 millimetres) under local anæsthesia, and on November 10 another œsophagoscopy was performed under local and an unsuccessful attempt was made to dilate the spasm. December 28, under gas-oxygen-ether sequence, the œsophagoscope was passed. There was some difficulty in passing the crico-pharyngeus. A small amount of food was aspirated and a 20 F bougie was introduced through the hiatus and the œsophagoscope passed with little difficulty over the bougie to a point 52 centimetres from the upper incisor teeth. Upon withdrawal of the instrument no lesion of the surface was seen. Following the dilatation a small stomach tube was passed easily for several days and the patient was fed through the tube, but soon this was no longer possible and the treatment was abandoned. Since the patient had shown no permanent improvement and he had even more difficulty in swallowing than before dilatation, he was transferred to the surgical service, and on January 24, 1928, under nitrous-oxide-oxygen-ether anæsthesia, an operation was performed for the permanent relief of his cardiospasm.

FIG. 4.—Introduction of ligature.

Operation.—A high, left, paramedian incision was made with the patient in the reversed Trendelenburg position. The stomach was not contracted but the cardia was high and somewhat inaccessible owing to the anatomical conformation of the thorax which was long and narrow. The cardia was loosened from its diaphragmatic attachment, and the freedom of the œsophagus in the mediastinum permitted it to be drawn down about two inches. A thickened, contracted area was evident at a point above where the diaphragm was detached and this contracted area did not disappear when an attempt was made to invaginate the stomach wall through it with the index finger. The cardiac end of the stomach was freed from its splenic attachment sufficiently to permit its being attached to the drawn down œsophagus close to the diaphragm by two rows of sutures

placed longitudinally such as are used for the posterior sutures in the first stage of a Finney pyloroplasty. (Fig. 3.) The first row of sutures passed through the peritoneum on the stomach side and the superficial muscular layer on the œsophageal side. The second row passed through the peritoneum and muscular layers on the stomach side and the muscular layer on the œsophageal side.

If the left vagus is in the field of operation it should be pushed aside, and if the œsophagus is not sufficiently tortuous and elongated to cause lengthening of the left vagus, the vagus should be divided.

A Reverdin needle threaded with heavy, silk fishline was then passed from below upward into the stomach parallel to the suture line and a short distance to the left of it, to emerge from the stomach near the diaphragm where it was unthreaded and withdrawn. It was reintroduced unthreaded, in a similar manner at the right of the suture line to emerge from the œsophagus above the spasm area and close to the diaphragm. Here it was again threaded, using the upper end of the fishline, and withdrawn, the two ends then being tied after the method of the old McGraw elastic ligature to include the tissues to be divided. (Fig. 4.) The strength of the fishline enables it to be tied with sufficient force to ensure complete devitalization of the tissues included. If rapid division of the tissues included in the ligature is thought necessary, a rubber band one-eighth inch in diameter can be included in the carrier with the fishline and secured under tension after the ligature is tied. After the fishline ligature was tied, the stomach wall was drawn over in front of the area where the ligature had been tied and sutured to the œsophagus in front so as to completely bury the fishline ligature. (Fig. 5.) A small Dakin tube was introduced under the diaphragm on the right side and another placed on the left side. The wound was closed in layers. The patient was placed in bed in the Fowler position.

FIG. 5.—Stomach wall drawn over buried ligature (puckering by ligature not demonstrated).

Following the operation no food was given by mouth for seven days, but the patient received 2,000 cubic centimetres of normal saline solution intravenously each day and an abundance of nutritive fluids per rectum by Murphy drip. The drainage tubes were removed on the fifth day.

One month after the operation X-ray examination showed a marked diminution in the size of the œsophagus. There was only slight delay in the passage of the barium through the hiatus, which was slightly narrowed. Ten minutes after the meal a very small amount of barium was visible in the lower end of the œsophagus and there was only a trace after thirty minutes. There was slight irregularity in the outline of the stomach at the site of the œsophageal opening. Two months after operation œsophagoscopy was performed without anæsthesia and the tube introduced to 49 centimetres. The œsophagus was no longer dilated, the mucosa was clean, smooth and pinkish in appearance and there were no food particles present. The site of the operation could not be seen but there was

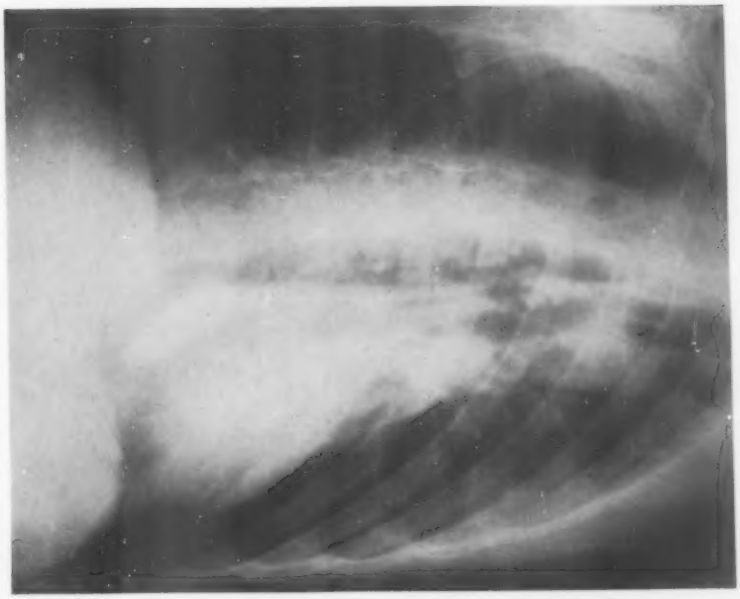

Fig. 6.—Slight interruption in passage of barium after operation.

Fig. 7.—Absence of barium ten minutes after meal.

infolding of the mucous membrane suggestive of it. The œsophageal wall closed normally over the tube as it was withdrawn and the surface was easily seen throughout.

X-ray examination nine weeks after operation showed that there was no œsophageal dilatation and but slight delay in the passage of the meal at the hiatus, as shown in Figure 6, the œsophagus being completely empty ten minutes after the meal. (Fig. 7.) There was an apparent increase in the size of the œsophageal opening and slight irregularity in the outline of the stomach at the location of the enlarged opening.

It is a well-recognized fact that the best criterion of the success of a procedure is the condition of the patient. Five weeks after operation he had gained eight pounds and three months after, at the present writing, he weighs 134 pounds, a gain of twenty-one pounds over his admission weight, and in the words of the Ward Surgeon as transcribed in his progress notes, "The patient has made an uneventful recovery. He takes all articles of food without distress and with evident enjoyment."

The operation is not offered as a substitute for the non-operative treatment of those forms of cardiospasm which are dilatable by an expert and which do not recur. But, it is pointed out, experts are not always available, and what constitutes an expert in the use of the hydrostatic or other forms of dilatation is not easily determined. Certainly the handling of from five to ten cases spread over a number of years does not indicate expertness in any field and especially in this one where individual genius is often a determining factor. There is a recognized low mortality and 25 per cent. recurrence during the first six months with the non-operative treatment in the hands of an adept, but judging from recent publications,[5, 6] the mortality is higher and the percentages of recurrence greater with those of more limited faculties. These are some of the factors that must influence the surgeon when he is compelled to decide between an operation such as this, on the one hand whereby danger of infection is minimized and which can be carried out under direct visual control supplemented by palpation, and, on the other hand, the different forms of dilatation performed by those of limited experience.

If further use of this method shows that all varieties of cardiospasm respond to this form of treatment, it will be possible for the general surgeon, who cannot always command the services of a specialist, to handle such cases with a reasonable assurance of success and a low mortality.

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MORTALITY FACTORS IN ACUTE APPENDICITIS *

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Beginning with the year 1886, when Fitz of Boston first coined the term "appendicitis" and published his memorable article, this disease for the next few years held the centre of the stage as far as surgical articles in the press and discussions at surgical meetings were concerned. In 1887, Morton of Philadelphia is reported to have deliberately performed the first appendectomy in the States. In 1889, McBurney wrote his epochal paper describing the point of tenderness which now bears his name, that was and too often, even to-day, is supposed to exist in all acute appendicitis cases. In 1894, Fowler made his great addition of the "Fowler position" and during the next ten years such masters as J. B. Murphy, Ochsner, Deaver, Richardson, etc., wrote many articles on this important subject. Since 1915, however, relatively few contributions on the subject have been made to the literature. In fact the thoughts of the physician and surgeon have been directed toward the discussion and investigation of whether subtotal gastrectomy or gastro-enterostomy is the best treatment for duodenal ulcer, or should a gall-bladder be removed, or simply drained. It is a strange coincidence that the mortality from acute appendicitis is reported to have risen since this same year—1915. Murat Willis [1] states that according to vital statistics the mortality of this disease in the United States has risen 31 per cent. since 1915. It further appears in literature that in Canada also the death rate has increased from this condition. One province quotes the increase as 8 per cent. In Alberta, Canada, deaths from appendicitis rose from 125 in 1923 to 136 in 1924. In England, Short states that deaths from appendicitis rose from 69 per thousand population in 1913 to 74 per thousand in 1923. It is difficult to ascribe this increase to any one particular cause. Probably the fact that appendicitis is no longer, generally speaking, considered a major surgical condition, and that the simple procedure of appendectomy has lost its terrors, and to-day is undertaken by hundreds of inexperienced operators as lightly as they undertake an amputation or a herniorrhaphy, accounts for some of the increase. Credence is to be given this idea because although the countrywide mortality at the hands of the vastly

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increased number of inexperienced surgeons is higher, yet at the same time, that of the big clinics and experienced men has decreased. The statistics quoted by Geery [3] throw much light in this direction.

Another probable cause is the fact that in the past many of the end results of neglected appendicitis were charged not to appendicitis mortality, but to perinephric abscess, liver abscess, septic pneumonia, typhoid fever, etc. To-day the fluoroscope has shown us that a pleural and pneumonic reaction may not be a septic pneumonia but due to a subdiaphragmatic abscess or a liver abscess, conditions rarely recognized before 1915 as being of appendiceal origin. To-day deaths from such are charged to appendicitis, and deaths they will be when encountered by the casual or inexperienced surgeon. It is one thing, as one surgeon aptly puts it, to remove a chronically diseased appendix from a thin abdomen, and quite another to do an appendectomy on an extremely obese woman with a gangrenous and ruptured appendix lying in the pelvis or retro-colic and high under the liver. Be the cause what it may, statistics show that the deaths occur in those cases where the diagnosis is delayed until the disease is no longer confined to the appendix. The fact that in simple or uncomplicated acute appendicitis, mortality figures in large series range from .5 per cent. to 1 per cent., whereas 8 per cent. to 14 per cent. mortality is charged against appendicitis complicated by rupture, abscess, peritonitis, pylephlebitis, etc., tends to confirm this opinion. Ashhurst.[4] Added to this is the fact that as König states 18 per cent. of acute appendicitis cases are admitted to the hospital with an incorrect diagnosis. It would seem therefore that the efforts of physicians should be toward early diagnosis. For that reason the writers have analyzed this group of 675 acute cases so proven by the laboratory reports and gross specimens. No cases of mistaken diagnosis or in which an innocent looking appendix was removed despite the pre-operative diagnosis of acute appendicitis, have been included in this series. Furthermore the diagnosis of peritonitis is limited to those cases with widespread lymph deposits on inflamed gut. Cases of abscess with cloudy fluid only are classed as "appendicitis with abscess." This explanation may possibly account for the fractionally higher mortality percentages in some instances. These have all been operated upon under one technic by the writer or one of his assistants, who have had varying degrees of experience. By the technic is meant that the same principles were carried out in all of them, namely, that as soon as a diagnosis was made the case was operated upon, that means *every* case was operated upon provided rigidity overshadowed distention and provided that the vascular system was still competent; a low blood pressure associated with a high temperature and cold extremities always contraindicate operation. There was one such case. Those cases that would fall in the group of delayed operation described by some surgeons were opened under local anæsthesia and a drain placed in the pelvis, no attempt being made to remove the appendix unless it presented in the wound. In this series we considered

only one case too sick to attempt a simple drainage treatment, based upon the experience that relief of great abdominal distention results in immediate improvement if it be only temporary as it often is. These figures, therefore, may be representative of work performed by, we will say, five surgeons of different skill and experience but under the same conditions.

Perusal of the following tables, I think, will show that it is the atypical case that produces the mortality because the diagnosis is not made until the case ceases to be a simple appendicitis. In this connection it may be well to briefly outline the typical case. In such the symptoms follow a definite sequence.

Primary Pain.—Pain of a colicky or cramp-like nature with more or less general distribution, begins rather suddenly and continues and increases in intermittent waves. At this period there is no rigidity or tenderness. This pain reaches its maximum usually in the first four hours (Birnie) and is complained of in the epigastrium or around the umbilicus.

Primary Nausea and Vomiting.—These follow the primary pain within an hour or two and continue for a short time only.

Secondary Pain and Tenderness.—At this time, four to eight hours after the onset of the disease, the pain, now more or less constant with exacerbations, becomes localized at "McBurney's point" and is associated with tenderness and muscular rigidity in this region. The vomiting has now ceased.

Shortly after the pain (two to six hours) there is some rise of temperature, usually around 100°–101°. The rate of the pulse is somewhat increased and there is an increase in polymorphonuclear leucocytes. There is a tendency to constipation and the patient is usually restless. Any case that deviates from the above is more or less atypical. Livingston in his recent analytical table on acute appendicitis found that typical pain occurred in 75 per cent., nausea and vomiting in 70 per cent., rise of temperature in 67 per cent., local rigidity in 59 per cent. and leucocytosis in 76 per cent. of the cases. In other words only 69+ per cent. of the series were typical. Our series will approximate this very closely. For the purpose of study the cases have been considered from the standpoints of:

Age.—In numerous places in the literature reference has been made to the fact that acute appendicitis is chiefly a disease of youth and early adults. One author states that 50 per cent. of the cases occur under twenty years of age. Müller and Ravdin[6] report on fifty-eight children, the youngest four years of age. In their series 34.4 per cent.[8] occurred in the first ten years. In Alexander's series 49.2 per cent. occurred between the sixth and tenth year. Peterson[8] in a group of sixty-two cases, 75 per cent. of which were acute, found 60 per cent. had perforation or abscesses. He quotes a mortality of 9.67 per cent. in children and states that appendicitis under five years of age is not at all uncommon and that under two years of age it is overlooked. The condition occurs in earlier life but infrequently, fortunately, for the per cent. of delayed diagnoses is extremely high (90

per cent. drainage in cases under three years) with a resultant high mortality—10 per cent. Maes [7] finds the same conditions prevailing at the other extreme of life. He states that after fifty years the mortality is high (10 per cent.). In our series shown below the same conditions obtain.

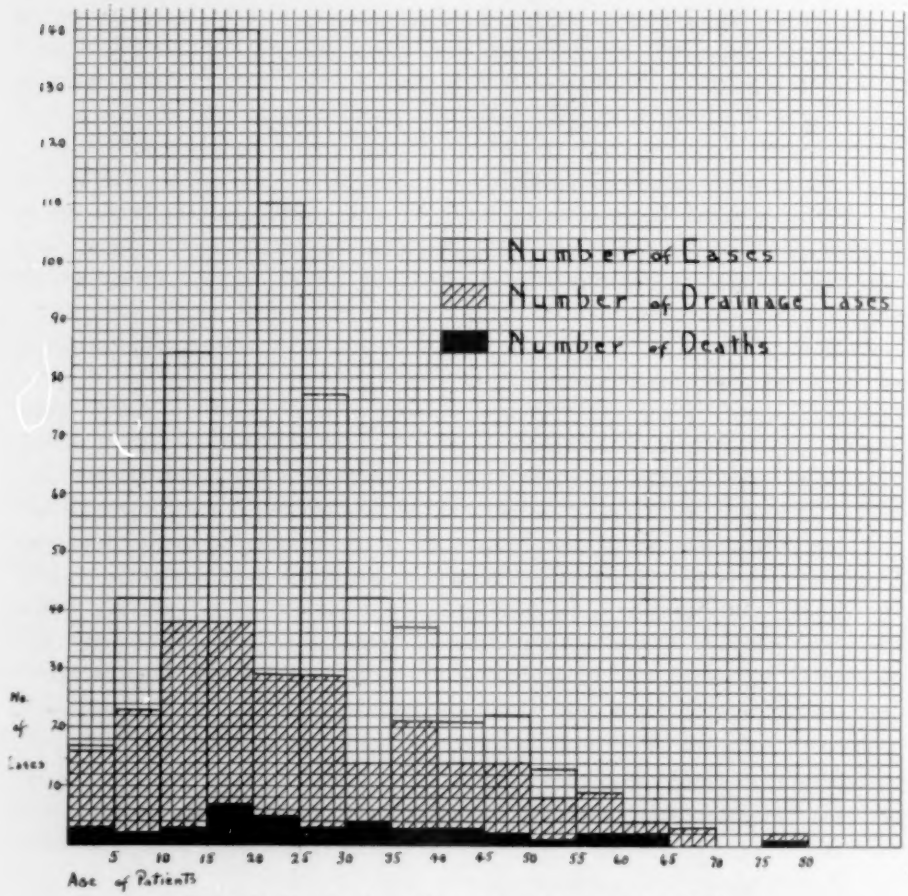

CHART I. Showing the relation of age, drainage and mortality.

It will be noted that in this series the incidence of drainage is highest at the two extremes of life. Under five years drainage was necessary in 94.1 per cent. of the cases and after fifty-five years of age, drainage was necessary in 100 per cent. of the cases and mortality increases to 27.8 per cent. The period of lowest drainage per cent. was between twenty and twenty-five years of age, namely, 26.3 per cent. Thus we see that drainage was necessary in at least one in every four cases, even those ages in which appendicitis is most often suspected. Our youngest patient was twenty months old, 2.7 per cent. of our cases were five years or younger, and 9.4 per cent. of the series were ten or under. Our mortality of 8.4 per cent. in this latter group compares well with the figures of Peterson.

TABLE I.

Per cent. of Drainage Cases According to Age.

Age		Age	
0– 5	94.1%	40–45	66.6%
5–10	54.7%	45–50	63.6%
10–15	45.2%	50–55	61.5%
15–20	27.1%	55–60	100 %
20–25	26.3%	60–65	100 %
25–30	37.2%	65–70	100 %
30–35	33.3%	70–80	100 %
35–40	56.6%		

McBurney's Point Symptoms.—Many of the cases of delayed or erroneous diagnoses are due to the fact that too much importance has been attributed to pain, tenderness and rigidity at this historical point. As quoted above, Livingston found typical pain and rigidity in only 75 per cent. of his cases and local rigidity in only 59 per cent. of the cases. In other words, only three out of every four cases have the sign we were all taught to be indicative of acute appendicitis. It is the experience of us all to have the physician diagnose a retro-colic appendicitis as pyelitis or a pelvic appendicitis as "indigestion."

Gladstone and Wakeley [9] observed the position of the appendix in 3000 cases and found the appendix in the pelvis in 27.5 per cent. and 69.2 per cent. post-cæcal and retro-colic. Morison [10] states that the pelvic appendix is very common and misleads the diagnostic experts in that it gives no right-sided symptomatology. In our experience the pelvic appendix most often gives epigastric pain and rectal tenderness with some tenderness over and rigidity of the extreme lower end of the right rectus abdominis muscle. Pressure over this area frequently gives the patient pain in the epigastrium. The following table illustrates the McBurney point fallibility.

In a series of 468 cases, only 44.7 per cent. had pain at McBurney's point, whereas 31 per cent. had rectal pain and tenderness. It will interest us also to find that in the pelvic cases 16.9 per cent. had epigastric pain. Examination of the last column shows the high incidence of rectal tenderness in all cases, an evidence of soiling of the peritoneum at least. Pain in the left pelvis invariably means either a pelvic abscess or peritonitis. It must be borne in mind that appendiceal or "secondary pain" and tenderness is present at site occupied by appendix, *i.e.*, a retro-cæcal appendix gives loin pain and tenderness; a pelvic appendix gives rectal pain and low rectus rigidity and tenderness, etc.

TABLE II.

Relation of Position of Pain to Location of Appendix.

Position of appendix	Loin	McBurney	Bel. ant. sup. spine	To rt. of umbilicus	Epigastric	Total	Rectal
Rt. of cæcum	45.1%	49. %	5. %	....	....	51	13.7%
Below cæcum	....	84.6%	15.4%	....	....	103	23.3%
Left of cæcum	....	30.1%	9.6%	60.3%	....	73	23.2%
Retro-cæcal	39.4%	45.4%	15.2%	....	....	99	18 %
Pelvic	....	20.4%	61.9%	....	16.9%	142	57 %
Totals	13.2%	44.7%	27.3%	9.4%	5.1%	468	31.4%

In this next table of 480 cases, 30.2 per cent. of the cases had the appendix in the pelvis.

The column in the table headed Post Cases was made from consecutive autopsies on other than appendicitis cases at the Philadelphia General Hospital.

TABLE III.

Position of Appendix—Operated Cases.

	Cases	Per cent.	Post Cases
Right cæcum	52	10.8%	....
Left cæcum	75	15.6%	33 %
Below	109	22.7%	....
Retro-cæcal	99	20.6%	32.4%
Pelvic	145	30.2%	10.7%

The relation of the position of the appendix to abdominal rigidity was very interesting. It will be noted at least one-fifth of the cases had no rigidity, at least no mention of it was made in the history report. When the appendix lay to the left of the cæcum and tucked under the ileum just over the brim of the pelvis in what we have fancifully termed the swallow nest position, rigidity was absent in 34.2 per cent. of the cases. In our experience those patients displayed the most rigidity in which the appendiceal inflammation extended by contiguity to the abdominal wall. And on the other hand, when the diseased appendix was covered by bowel or omentum so that the abdominal wall was not involved in the early inflammatory process, rigidity was not a prominent symptom until later when the disease process had spread to the general peritoneal cavity.

TABLE IV.

Relation of Position of Appendix to Presence of Rigidity.

Position of appendix	No. of cases	Rigidity	No rigidity
Right of cæcum	49	79.6%	20.4%
Left of cæcum	76	65.8%	34.2%
Below cæcum	106	78.3%	21.7%
Retro-cæcal	98	82.7%	17.3%
Pelvic	140	78.6%	21.4%
Location unknown	138	76.8%	23.2%
Totals	607	77.2%	22.7%

Nausea and Vomiting.—These symptoms do not always occur, appearing in only about 70 per cent. of the cases according to reports. It is most often absent in the pelvic, 25 per cent., the retroperitoneal, 34 per cent., and the extra-cæcal, 30 per cent., type of disease. When it does occur it frequently happens as the immediate result of some medication, most often a cathartic taken by mouth. It is never a prominent symptom and may appear but the once. If present, however, it does not persist after the first

few hours, at which time the pain has become localized. Should it recur later (secondary vomiting) it is an indication that there is a spread of the disease beyond the appendix itself, either into the peritoneum or the portal system as a pylephlebitis.

Vomiting is not a dependable sign, being especially unreliable in children and old people. In fact none of the objective signs indicate the gravity of the situation in the aged.

Examination of the next table discloses the relation of nausea and vomiting to the position of the appendix. In 596 cases nausea and vomiting occurred in 68.2 per cent. Nausea and vomiting were absent in 20.6 per cent. of all the cases and this absence was most frequent when the appendix lay to the right and outside the cæcum and next when it lay to the left of the cæcum and beneath the ileum.

TABLE V.

Relation of Nausea and Vomiting to Position of Appendix.

Position of appendix	Nausea and vomiting	Nausea only	No nausea and vomiting	Cases
Right cæcum	63.5%	9.6%	26.9%	52
Left cæcum	67.0%	7.0%	25.7%	70
Below cæcum	73.6%	10.4%	16.0%	106
Retro-cæcal	70.3%	11.0%	18.6%	91
Pelvic	66.4%	11.2%	22.3%	143
Location not known	67.1%	14.9%	17.9%	134
Total group	68.2%	11.1%	20.6%	596

Temperature.—Here again we have an unreliable sign. In reported cases it is present in from 67 per cent. to 70 per cent. and in most cases it reaches under a 100.5 per cent. This is so noticeable that high temperatures—103°–104° in adults—should direct attention to extra-peritoneal conditions such as pneumonia, pyelitis, endometritis, influenza, etc., especially when associated with a real chill. According to Colp [11] a chill during the incipience occurs in about 5 per cent. to 7 per cent. of the cases regardless of the type or extent of the pathology at that time. Of these 5 per cent. about 5 per cent. develop pylephlebitis. He found but little difference in the mortality of those with and without early chill. Eighty-eight per cent. of those of pylephlebitis gave a history of ante-operative chill. In our series of 675 cases there were thirty with chills (4.8 per cent.) with a mortality of 10 per cent. Of these eight had abscesses, seven general peritonitis and one a phlebitis.

The high temperatures occur in the retroperitoneal cases and those cases occurring during or immediately following pharyngeal or respiratory infections.

The question of increase of temperature likewise is of interest here. In 586 cases it is noted that (169) 28.8 per cent. had temperature below 99°, (299) 51 per cent. had temperature between 99° and 101° and only (118) or 20 per cent. had fever of 101° and over.

TABLE VI.

Temperature—586 Cases.

Below 99°	99° to 101°	101° and over
169 cases	299 cases	118 cases
28.8%	51%	20%

Leucocytosis.—Here again is an untrustworthy single sign. Leucocytosis of 8000 or more is absent in 20 per cent. of cases. Yet a low count as is well known is not necessarily a good omen. In one of our cases a count of 5000 with a normal T. P. R. were associated with a gangrenous appendicitis. These cases with a low leucocytosis and a high temperature always did badly.

In this series 570 had leucocyte counts. Of these 106 (18.6 per cent.) were below 10,000 and 252 (44 per cent.) were between 14,000–18,000.

Leucocytosis

Below 10,000	18.6%	106 cases
14,000 to 18,000	44.0%	252 cases
Total cases	570	

Cathartics.—It was thought in the beginning of this report that the mortality in cases of cathartics would be much higher than those without cathartics, but our figures do not show much difference. The time element is the important one. A cathartic given at the onset of the disease will probably do little harm if the patient has his appendectomy within twelve to fourteen hours, again harking back to the early diagnosis. Cathartics administered early or late with delayed operation probably are responsible for some complications and mortality. It is best therefore to resort to enema as it is safest and what is more to the point does not confuse the issue.

Perforation.—It has been the experience of the senior writer that perforation occurs very rapidly in certain types of cases. Acute appendicitis concurrent with acute tonsillitis progresses rapidly and perforation may occur in ten to twelve hours. The other type that perforates early is that in which the ulceration occurs near the base of the appendix. These cases are extremely dangerous because of the fact that protective adhesions do not form and walling off never occurs, consequently a general peritonitis and death is the result if early intervention is not undertaken. In this last type case the pain frequently begins locally over the appendix and does not occur as generalized or umbilical pain at all. The appendiceal colic due to fecalith obstruction gives this same type of pain.

The next table is of much interest. It will be noted that the highest incidence of peritonitis was in the second twenty-four hours. It is also of note that approximately 50 per cent. of the cases, namely 300, did not reach the surgeon until in the third day and that 34 per cent. did not reach the surgeon until the fourth day, which period gives the highest mortality—12.7 per cent.

TABLE VII.

Relation of Duration of Disease to Mortality, Drainage, Peritonitis and Abscess Formation.

Day of disease	No. of cases	Died	Drainage	Peritonitis	Abscess
1	235	2.5%	26.0%	8.0%	3.8%
2	122	10.6%	48.0%	26.0%	14.0%
3	69	7.2%	52.0%	11.0%	28.0%
4	47	12.7%	53.0%	10.6%	36.0%
5	24	12.5%	41.0%	12.0%	25.0%
6	14	7.1%	57.0%	14.0%	35.0%
7	30	6.6%	66.0%	10.0%	46.0%
7 +	44	4.5%	66.0%	6.8%	59.0%

Treatment.—When a diagnosis is made of acute appendicitis operation should be performed at the earliest possible moment, unless the patient has a low blood pressure, a high temperature with cold extremities and distention predominating over rigidity associated with diminished pain and a silent abdomen. Ashhurst very properly states that to delay operation in acute appendicitis is to gamble with death. Furthermore, although delay may not result in peritonitis, it may result in abscess which if neglected causes pressure necrosis and a fecal fistula later. In cases of doubt as to whether an acute or some other infection in the appendix or some other adjacent organ is the cause of the peritonitis, an operation should be undertaken, because of the fact that 75 per cent. of acute right-sided peritonitis is due to appendicitis in adults and in children this per cent. is even higher. In other words a patient exhibiting persistent colicky pain followed by nausea and vomiting, localized tenderness and rigidity and pulse hurry should direct one's attention to surgery. It is safer to remove 100 normal appendices than to let one perforate.

These cases were all operated upon, at once, most of them through a gridiron or muscle splitting incision, many of them under local anæsthesia and the appendix was removed whenever possible, which was in all cases in which it could be recognized. Drainage was by means of Mikulicz and split tube drains, when necessary, in the pelvis at the site of the abscess and in peritonitis cases outside the cæcum up toward the liver. The post-operative treatment is a pint of 2½ per cent. sod. bicarb. and 5 per cent. glucose given by bowel on the operating table in all cases. In peritonitis cases the Ochsner treatment was carried out with the addition of a constant massive flaxseed poultice to the abdomen. The fluids used by bowel are Murphy drip of first pint tap water with dr ii of tinc. digitalis; second pint 2½ per cent. sod. bicarb., and third and subsequent pints 5 per cent. glucose. If bowel is unretentive salt solution or even 5 per cent. glucose in 1/32 per cent. novocaine solution is given by continuous hypodermoclysis. In very ill patients, continuous intravenous is used.

Complications.—Examination of the table below discloses the fact that peritonitis and intestinal obstruction lead the field. In the treatment of the latter an early enterostomy under local anæsthesia was practiced. By early

enterostomy is meant when abdominal pain associated with tumultuous showers of peristalsis were not relieved by enema and change of position. To combat pulmonary complications a pneumonia jacket and camphorated oil rubs are augmented by instructing the patient to take ten deep inspirations every hour. Chewing gum or fruit lozenges are given as a preventive against parotitis.

TABLE VIII.

Complications in 675 Cases.

	No.	%	Died	%
Peritonitis	27	4.2	22	3.5
Secondary abscess	4	0.62	2	0.46
Pylephlebitis and liver abscess	7	1.25	3 (1) *	0.62
Fecal fistula	3	.46	(two healed)	
Intestinal obstruction	12	1.8	7	1.08
Secondary hæm.	1	0.15	1	
Phlebitis	4	.62		
Embolus	1	15.		
Pneumonia	8	1.25	2 (1) *	.46
Atelectasis	3	.46		
Pyelitis	3	.46		
Parotitis	2	.30	1	.15
Acidosis	1	.15		
Table death	1		1	
Unopened			1	

* See next table.

TABLE IX.

Mortality.

Total group	675 Cases	%
Deaths	37 (3)*	5.3 (.9)
Cause of death		
Peritonitis	22	3.2
Intestinal obstruction	7	1.
Residual abscess	2	2.
Liver abscess	3 (1)*	0.4
Pneumonia	3 (1)*	0.4
Table death	(1)*	.1 +
Parotitis	1	.1 +
Unoperated	1	

* These three deaths, one with multiple liver abscesses, diagnosed before operation, a second with pneumonia at time of operation and the third, a death on the table ten minutes after start of operation, we think are fairly excluded from an acute appendicitis death. With these excluded acute appendicitis in our hands gave a real mortality of 5.5 per cent. The undrained cases gave a mortality of 1.07 per cent. Total operated cases gave a mortality of 5.3 per cent. (.9).

SUMMARY

This series is a post-operatively and pathologically proven number of acute cases treated under one technic. These are all the acute appendicitis cases admitted to the senior writer's service in the last few years and with the exception of one, were all operated at the earliest possible moment. This one case was moribund and hence not operated upon. The series, therefore, is a true analysis of the treatment of all acute appendicitis cases during that period in

the hands of one senior and four junior surgeons with experience varying from three months to three years. Three years is the length of service in the surgical fellowship at the University of Pennsylvania. Eliminating one death on the table and one case of multiple liver abscesses (ten days duration) diagnosed before operation, the mortality was 5.5. One other mortality, that of a child admitted to the hospital with a temperature of 104 [2] with a right-sided pneumonia, so diagnosed by the pediatrist, and a coincident ulcerative appendicitis. Although the patient had cloudy fluid there was no perforation and the death was a pulmonary one. Eliminating this pre-operative pneumonia case, the mortality could fairly be said to be even lower.

From sixty to seventy per cent. of cases in this series were atypical in one or more of the symptoms. This leads to difficulty of diagnosis which means in turn delay. Delay is shown to increase the mortality enormously, chiefly because of abscess, peritonitis and intestinal obstruction.

Peritonitis was diagnosed as such when the intestines were inflamed and showed organizing lymph patches. The mere existence of cloudy fluid did not warrant such a diagnosis. Peritonitis was the greatest factor in the mortality, intestinal obstruction was second. There was only one permanent fecal fistula, a tuberculous appendicitis and typhlitis.

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THE GIBSON-MIKULICZ DRAIN IN ACUTE APPENDICITIS

WITH REPORT OF 1588 CASES

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The question of drainage of cases of acute peritonitis is still one of the problems of surgery concerning which there is a diversity of opinion. There is as yet no general agreement not only regarding when and when not to drain, but also concerning the type of drain to be used. Doctor Gibson[1] first reported his use of this drain in 1916 and[2] described it in 1921. Also in 1921, Doctor Farr[3] reported a group of cases of acute appendicitis with peritonitis in which this drain was used. The purpose of this report is to amplify and bring up to date the last-mentioned paper and includes in its statistics the cases reported at that time.

The Gibson-Mikulicz drain has been used on the First (Cornell) Surgical Division of The New York Hospital for over fifteen years and as its advantages have become more apparent, has at the present time almost entirely replaced all other forms of drainage in cases of peritonitis. As there has been no change made in the drain itself, Gibson's original description is quoted:

"A square of rubber dam of suitable size is folded two or three times in the form of a cornucopia. The apex, which will eventually be the lowest point of the dam, is snipped off, making the hole the size of the little finger. An inch and a half above this the edges of the cornucopia are cut out, making a perforation about one-half inch in size. In some cases a second row of perforations is cut about one inch higher up. The tampon is then introduced as follows:

"After the appendix has been removed and the cavity sponged out of all purulent material and blood, the operator carries the tampon into the cavity, the index finger being placed at its apex. The pads and retractors are still in place. The edges of the rubber dam are spread out and while the operator still keeps his finger on the apex, the tampon is filled with strips of packing."

It is best to overstuff the cavity so that when the drain is removed, as is done on the third or fourth day, we have a cavity the size of two fists, in the average adult, surrounded by omentum and loops of intestine. A tremendous amount of material drains from such a wound in the first forty-eight hours, while the temperature and pulse drop almost immediately and the improvement in the general condition of the patient seems miraculous.

Between January 1, 1914, and January 1, 1927, there were 1588 cases of acute appendicitis ranging in age from two to seventy-two treated on the First Division. Of these, 728 or 45.84 per cent. were closed without drainage. These were the cases where there was no peritonitis or where there was only

a moderate amount of turbid fluid without odor present. Eight hundred and sixty or 54.16 per cent. of the cases in the opinion of the operators required drainage. It is worthy of note that over half the cases required drainage and that more than three-fourths of the total number did not enter the hospital until on or after the third day of their illness.

The mortality for the whole group was 78 or 4.9 per cent. The mortality for the 728 undrained cases was 4 or 0.55 per cent., showing the great advantage of early operation before the infection has spread to the surrounding tissues. Of these four deaths, two, middle-aged patients, died of myocarditis, one died of pulmonary embolism, while the fourth died of paralytic ileus and peritonitis.

As proof of a theory that the feminine sex seek medical advice earlier than the masculine, it was found that while 46 per cent. of the total series were females, only 30 per cent. of the drained cases were of this sex.

An attempt to divide the drained cases into three groups was made. Group No. 1 contains those cases where the appendix was completely necrotic or where it was ruptured in removing, or could not be satisfactorily inverted; also cases where oozing could be controlled only by packing; Group No. 2 consists of those cases where there was a spreading peritonitis with no limiting adhesions; Group No. 3 were the cases having a definite walled-in abscess separated from the general peritoneal cavity. It is in the second or most severe group that Gibson-Mikulicz drain is, in our opinion, of greatest value.

Because of variations in methods of classifying cases, no attempt is made to compare our series with cases reported from other clinics, but an attempt has been made to compare the Mikulicz drained cases with similar cases in our own clinic where other methods have been employed. These other methods were largely employed in the first four or five years of the thirteen years under consideration because, as already stated, at the present time the Gibson-Mikulicz drain has almost entirely replaced all other forms of drainage.

Of the 860 drained cases, 197 were drained with a folded rubber dam drain as follows:

	Cases	*Deaths*	*Per cent.*
Group No. 1	146	2	1.37
Group No. 2	18	4	22.22
Group No. 3	33	1	3.33

Cigarette drains were used in 179 cases.

	Cases	*Deaths*	*Per cent.*
Group No. 1	121	3	2.47
Group No. 2	19	6	31.57
Group No. 3	39	1	2.56

Rubber tube used in 37 cases.

	Cases	*Deaths*	*Per cent.*
Group No. 1	18	0	0.00
Group No. 2	10	2	20.00
Group No. 3	9	1	11.11

Gibson-Mikulicz used in 455 cases.

	Cases	*Deaths*	*Per cent.*
Group No. 1.....	46	2	4.34
Group No. 2.....	235	47	20.00
Group No. 3.....	164	5	3.04

Iodoform gauze was used in one case and silkworm gut in one case.

These tables show that in cases of peritonitis the Gibson-Mikulicz drain gives as low or lower mortality than any other form of drainage in the hands of the same operators. There are, in our opinion, several other distinct advantages to this type of drainage.

(1) Immediate lessening of toxicity as shown by lowered temperature and pulse has already been mentioned.

(2) Another important factor is that in removing this type of drainage, there is probably no pain. The old type gauze Mikulicz drain became densely adherent to surrounding structures and had to be pulled out by main force.

(3) In a majority of cases the wound is left entirely open, no sutures being introduced. This means that there is absolutely no secondary infiltration or infection of the abdominal wall and consequently no sloughing of tissues, particularly of the fascia.

(4) Formation of pocketing and secondary abscesses are almost non-existent.

(5) Doctor Gibson[4] has called attention to the small number of fecal fistulæ occurring in our series, which we credit largely to the wide-open type of drainage. He reported an incidence of 1.2 per cent. as compared with 5 per cent. reported from another clinic.

(6) Because of the protective action of the rubber dam, the adhesions formed, while firm enough for the immediate purpose of forming an abscess cavity, are not of the dense fibrous type, and rapidly disappear. In cases operated a year or more later for hernia, it is remarkable to find practically no adhesions in this region. Only one case in the series had to be reoperated for adhesions.

There have been some disadvantages called to our attention which we feel are far outweighed by the advantage of this drain.

(1) Increased length of stay in hospital. This averaged 23.4 days with Mikulicz drain and from 17.1 to 18.6 days with other types of drainage.

(2) Occurrence of herniæ. Theoretically all these cases should develop herniæ, but actually of 344 cases followed for one year or over only 14 per cent. had herniæ, while occurrence with other types of drainage varied from 5.5 to 6.8. Since abandoning the McBurney incision and using only the right rectus, this has dropped to 11.4 per cent. When such herniæ occur they are extremely simple to repair, as there has been no loss of tissue. All that is needed is to differentiate the various layers and bring them together.

(3) Possibility of evisceration: This occurs very rarely and practically always in moribund cases where no attempt to form adhesions has taken place. There was no case in the series in which this occurrence was considered the cause of death.

While for the purposes of this report, only cases of appendicitis were studied, still the Gibson-Mikulicz drain is applicable and useful in many other types of cases. It is of particular value in extensive retrocæcal neglected abscesses. Gall-bladders with severe infection of the surrounding tissues seem to be more easily and efficiently drained with this type than with other forms of drainage. Pelvic infections are easily drained through the vagina with this drain. Only recently I had a gunshot wound of the hepatic flexure of the colon. There was rather extensive damage to the wall, with considerable soiling of the surrounding area. By the use of two Mikulicz drains, I was able to pack off the whole region and keep the infection localized, thus preventing the usual sequelæ of a generalized peritonitis, and providing an extremely smooth convalescence.

I am extremely grateful to Dr. Charles L. Gibson for permission to publish these cases, all of which were operated by him and his assistants at The New York Hospital.

Tables showing mortality by decades, and occurrence of herniæ in relation to the type of incision are appended.

Mortality by Decades in Drained Cases:

Age	*Cases*	*Deaths*	*Per cent.*
2–10	115	11	9.56
11–20	265	16	6.03
21–30	208	13	6.25
31–40	118	8	6.77
41–50	80	9	11.25
51–60	60	13	21.66
61–70	13	4	30.76
71–80	1	0	0.00

Herniæ in Mikulicz Cases:

Right rectus split	147 cases followed	
	19 herniæ	
	12.92 per cent.	
Right rectus retracted in	111 cases followed	
	10 herniæ	
	9.00 per cent.	
Right rectus retracted out	22 cases followed	
	3 herniæ	
	13.63 per cent.	
McBurney incision	61 cases followed	
	16 herniæ	
	26.22 per cent.	

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CONGENITAL ABSENCE OF THE GALL-BLADDER

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from the Samaritan Hospital

Congenital anomalies of the liver and gall-bladder are rare. The presence of two livers in a human being is the rarest condition. Eshner gives Morgagni credit for reporting such a case; the gall-bladder was absent. I have been unable to find another such case in the literature. The next rarest anomaly is the absence of the gall-bladder and all ducts. This condition one would naturally suppose to be incompatible with life but such is not the case. Thirteen cases have been reported, one infant lived 216 days; another 150; another ninety, and still another seventy-seven, etc. Strangely enough only two of the thirteen lived less than twenty-four hours; the average duration of life for the thirteen being seventy days. The next rarest anomaly is absence of the gall-bladder, cystic and common ducts. Fourteen cases have been reported which with the case reported here makes a total of fifteen. This condition, of course, is compatible with normal existence, two of the patients having lived sixty years. The defect in each instance was not a contributing factor in the cause of death, one dying with pulmonary tuberculosis and the other with an infectious disease of unknown origin. Operation was not performed in either instance. The next rarest anomaly is the absence of the gall-bladder and cystic duct; thirty-one cases have been reported, the average age for this series being forty-eight years. Five of these were operated upon, three for a lesion involving the biliary tract—all were living when reported. Theodor, in 1908, reported the case of a male child, six weeks of age, on whom he did a hepatico-cholangio-enterostomy who died eight days after the anastomosis—the gall-bladder and cystic duct were absent. It is difficult to arrive at a correct estimate of the number of gall-bladders that have been absent without absence of the cystic duct because the surgeon or pathologist in most instances has not mentioned this structure. We have, therefore, only noted its presence when a definite statement regarding it was made. Four cases were reported, two in infants, ages three and eleven months, and two in adults, twenty-seven and twenty-eight years respectively. A true left-sided gall-bladder with viscus and common duct to the left of the falciform ligament is said by Schachner to have been reported thirteen times without transposition of other viscera. Double gall-bladder with double cystic ducts are infrequent.

The gall-bladder is said to possess a mesentery in about 5 per cent. of instances. Anomalies in the position of the ducts and of the blood-vessels supplying the liver and gall-bladder are common; according to Behrend,

occurring in the case of the ducts as frequently as 25 per cent. and blood-vessels 51 per cent. Variations in the lobulation of the liver are not uncommon. A slight fossa may or may not be present and therefore there may be no line of demarcation of the quadrate lobe. Of the twenty-nine instances in which the presence or absence of fissure was noted in the findings, at operation or autopsy, it was absent in thirty-one or 72 per cent. and present in eight.

Of the forty cases in which the gross appearance of the liver was noted, cirrhosis was diagnosed twenty-nine times; thirteen or 45 per cent. were of the hypertrophic and sixteen or 55 per cent. of the atrophic type. In adults over twenty years of age, the atrophic type was present in 70 per cent.; in infants under one year, 70 per cent. (seven out of ten) were of the hypertrophic type.

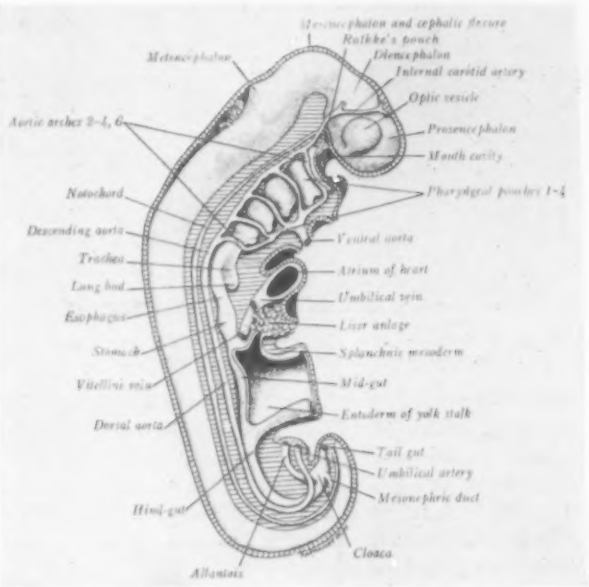

FIG. 1.—Shows the liver anlage as a median ventral outgrowth from the entoderm of the fore-gut, just cranial to the yolk-stalk. Its thick walls enclose a cavity which is continuous with that of the gut. This hepatic diverticulum becomes embedded at once in a mass of splanchnic mesoderm, the septum transversum.

The gross appearance of the pancreas was mentioned in but 20 per cent. of the cases; in one instance the head was missing; in three others the gland was atrophic; when mentioned in adults the pancreas in all instances was thickened, hard or indurated.

The size and position of the ducts were noted in twenty-four instances. This is important since dilatation by some is considered as evidence that the ducts are attempting to assume the function of the gall-bladder. The cystic duct was mentioned as being enlarged in two instances. Inasmuch as it was absent entirely in over 90 per cent. of the cases this observation would not help us in arriving at any conclusion relative to an accessory function of this structure. The common duct was noted as being dilated in nine instances, normal in four and not mentioned in eleven. The hepatic ducts were dilated in 50 per cent. of cases, normal in thirty, small in 8 per cent. and not mentioned in 12 per cent. One would be justified in concluding that an attempt at dilatation of the hepatic ducts, and probably less frequently, the common, was observed in 50 per cent. of the cases reported. While the average age of those who died with normal ducts was but thirty-six as compared with fifty-two years for those whose hepatic ducts were dilated, the first group died of various diseases which were

in no way associated with the pathology of the biliary system. The presence of atrophic or hypertrophic cirrhosis apparently had no bearing on the size of the ducts.

Report of Case.—J. B. S., male, aged fifty years. Family and previous history.—Mother died in confinement; father died age ninety years. One child living and well. Wife has had no miscarriages. No history of carcinoma or tuberculosis. Denies venereal infection but states that physician discovered four plus blood Wassermann in May, 1925, and that he was treated by injections for five months. Several weeks following this, patient developed attacks of suffocation associated with mediastinal pain which radiated to the epigastrium. The pain was dull and aching in character radiating at times to the umbilicus. It was not associated with nausea or vomiting and he was not confined to bed.

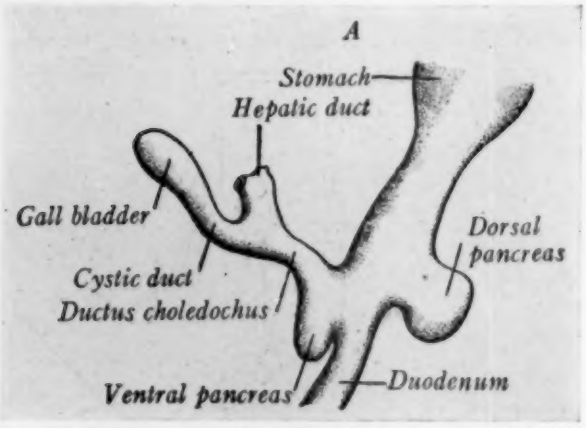

Fig. 2.—Reconstruction of the hepatic diverticulum. (Embryo 7 to 8 mm.) *Developmental Anatomy*, Arey, p. 111.

Present illness, April 2, 1925, patient was seized with violent upper right abdominal pain, cramp-like in character, the attacks lasting from five to ten minutes. He called his family physician who gave him a hypodermic. Since then he has had three similar attacks coming on at night, relieved by hypodermics but he was able to work the next day. With two of these attacks there was moderate jaundice, no other symptoms. The present attack began at 2 P.M., the pain was very severe but he obtained relief by taking soda bicarb which induced vomiting. The pain recurred eleven hours after the first attack and lasted for five hours. He was admitted to the American Stomach Hospital twenty-one hours after the onset of pain with a temperature of 98 and pulse of 102.

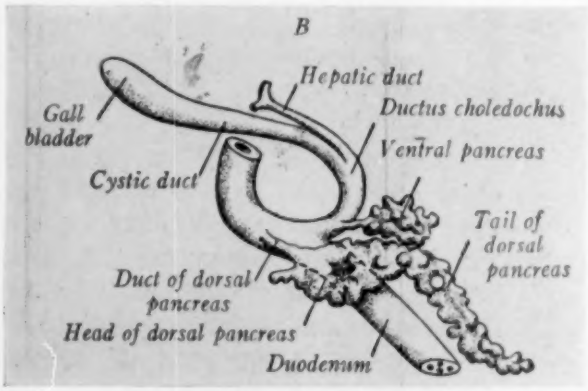

Fig. 3.—Further reconstruction of the hepatic diverticulum and pancreatic anlages in human embryo. Arey, p. 111.

Physical Examination.—Patient is a well-developed, well-nourished male, adult. Intelligent, coöperative. No cyanosis or œdema present but slight evidence of jaundice. No cranial deformity. Eyes and ears negative. Pupils normal, react to light and accommodation. Sclera has slight tint of jaundice. Teeth in poor condition. Tongue moist and coated. Chest—lungs negative. Heart not enlarged or displaced. Sounds normal. Pulse regular. Volume good. Abdomen.—Scaphoid—definite tenderness and rigidity in upper right quadrant. Liver dulness diminished. Small amount of free fluid in peritoneal cavity. Extremities negative. Nervous and genito-urinary systems negative. Diagnosis, acute pancreatitis or perforated duodenal ulcer.

Anæsthetic.—Intraspinal—Stovaine 5¾ c.g.m. in third lumbar interspace. Cerebro-spinal pressure diminished from 18 to 10 mm. of mercury by withdrawal of 3 c.c. of spinal fluid anæsthesia to sixth rib—preliminary dose morphine sulphate gr. 1/6, scopolamine gr. 1/100 one-half hour before operation.

Gross Findings.—Liver ptosed, extended 15 cm. below costal margin, normal in appearance, edge moderately sharp. *The left lobe was entirely absent, there was no gall-bladder or fissure present.* The left border of the right lobe approached to within 3 cm. of the midline of the abdomen. To the left of the centre near the posterior inferior border of the liver were a few adhesions binding it to the posterior border of the tail of the pancreas. The pancreas was exposed throughout its entire length. The head was swollen and hemorrhagic. Between the pancreas and the liver were large vessels, mostly veins as proved by aspiration. Using a 2 c.c. glass syringe and a hypodermic needle, we were unable to obtain bile from smaller vessels which we considered hepatic ducts on either side of the largest veins. There were grayish spots on the gastro-hepatic omentum which we took to be areas of fat necrosis although we were not positive. The duodenum was of normal size and position, the serous coat was injected. The stomach, small intestine and colon were negative. The appendix was atrophied, palpated as a thin cord attached to the right pelvic brim. The right kidney was slightly ptosed and of normal size. The left kidney was normal. The spleen was slightly enlarged.

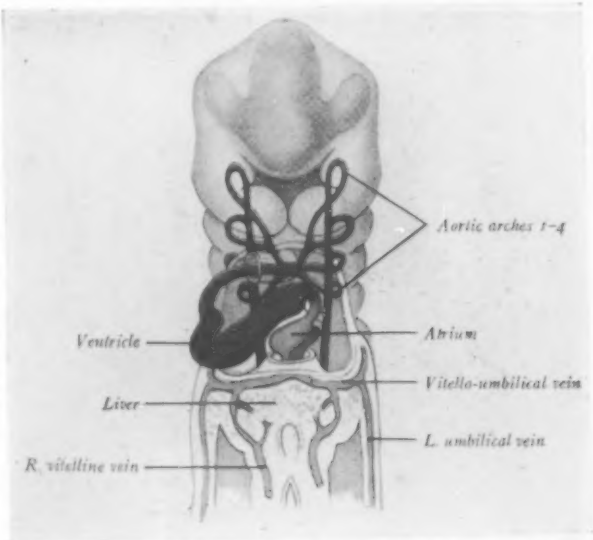

FIG. 4.—Ventral reconstruction of the blood-vessels in a 3.2 mm. human embryo. *Developmental Anatomy*, Arey, p. 187.

The adhesions were separated between the posterior inferior surface of the liver and pancreas and a soft rubber tube was placed at the head of the pancreas. The wound was closed with No. 2 chromicized catgut and interrupted silkworm gut and horse hair. Convalescence was uneventful. The drain was removed at the expiration of forty-eight hours; semi-solid food was given on the third day and he was discharged from the hospital on the fourteenth day. He returned to his occupation as solicitor but complained of hunger pain and food ease. He was admitted to the Samaritan Hospital where sodium tetraiodophenolphthalein was given both orally and intravenously without showing any evidence of a gall-bladder shadow; however a gastro-intestinal examination by Dr. G. C. Bird, röntgenologist, was made—the report of which follows:

X-ray Report.—Examination before the administration of barium did not show anything diagnostic in gall-bladder or liver area. In standing position greater curvature of the stomach was on a line with the umbilicus. There were no filling defects in the stomach but the cap did not fill. Plates made in the prone position do not show the duodenal cap. Examination at the end of twenty-four hours still showed a barium retention in the stomach. A sausage-shaped shadow is seen in the gall-bladder region which is outlined by flecks of barium. QUERY—has barium passed into the gall-bladder and is the gall-bladder located in the substance of the liver? (At operation it having been discovered that the gall-bladder was congenitally missing in its normal location.)

The blood Wassermann was negative as was the blood chemistry. The family physician reports that following a modified Sippy treatment for duodenal ulcer his hunger pain and food ease disappeared and he is at present symptom free.

Discussion.—While there is no gall-bladder in certain families of birds, fish, some of the rodents, the horse, deer, camel, rhinoceros and elephant, according to Scammon there are only three forms consistently lacking a gall-bladder that are commonly available, for embryological study. These are the lamprey (Petronyzon), the pigeon and the rat. He observed no common factors which would account for the absence of the gall-bladder in all of these examples. He states, however, "that in the rat it is possible that the rapid and early reduction in size of the yolk-stalk which leaves the foregut wall quite short antero-posteriorly may be a factor in inhibiting the development of the gall-bladder. While the occasional absence of the gall-bladder in man cannot be explained by these observations, it is interesting to note that of the three mentioned, one characteristic during the developmental stage is common to all, *i.e.*, atrophy of cells takes place. In the lamprey a complete biliary apparatus is formed in the larval stage, in the adult form there is a total degeneration of both gall-bladder and duct. In the pigeon the gall-bladder is developed in a perfectly normal way and later, in the majority of cases, at least, is completely lost. In the rat there is at most but a trace of cystic anlage in very early cases and this soon disappears.

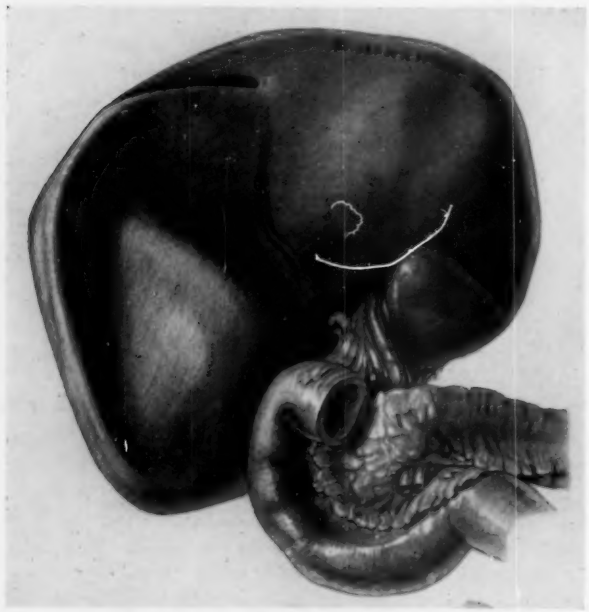

FIG. 5.—Congenital absence of gall-bladder. Left lobe of liver, cystic and common ducts absent. Hepatic ducts apparently very small. Pancreas of normal size, head considerably larger than depicted above.

In the human we have normally in the development of the liver a tremendous overgrowth of (liver) cells, the liver reaching the maximum size relative to the body at nine weeks. This is followed by a degeneration of liver substance, especially in the peripheral portion of the left lobe. While in the lower forms of animal life the atrophy of cells seems to be confined for the most part to the gall-bladder and ducts, in the human both liver and biliary apparatus are involved and in rarer instances the pancreas also is affected. Why there should be associated anomalies in the human can be readily understood when one studies the development of these organs in the embryo. Develop-

mentally the liver represents a diverticulum from the ventral side of the entoderm shortly beyond the stomach. (Fig. 1.) Two portions, a cephalic fairly solid portion and a caudal hollow one are early differentiated. (Fig. 2.) The latter, the lumen of which is continuous with that of the duodenum represents the gall-bladder. By a constricting process the ductus choledochus and hepatic ducts are formed and remain as the only connection which the cephalic or para hepatica retains with the duodenum. The paracystica in the meantime dilates to form the gall-bladder and elongates to form the cystic duct.

One or possibly two ventral evaginations from the entoderm are the anlagen also of the head of the pancreas and (Fig. 3) appear at about the same time as the liver. This would explain the associated defects in the pancreas, the absence of the head in Theodor's case and other associated defects. If the primitive liver anlagen becomes the gal'-bladder the glandular portion of the liver developing around it, one has no difficulty in explaining the intrahepatic gall-bladder. Deaver estimates that in infants 2 per cent. are totally intrahepatic. Under ordinary circumstances the tension within the gall-bladder gradually forces it to the surface, the hepatic cells covering it, gradually disappearing. The associated variations in lobulation of the liver can also be explained by the overgrowth and subsequent degeneration, of the liver cells as previously mentioned. It may be as Arey states that any abnormality of the fetal vitalline and umbilical trunks may result in abnormalities in the biliary apparatus and pancreas inasmuch as the external lobes of the liver seem to be molded under their influence. Figure 4 shows how the liver anlage lies between the vitalline veins and in close proximity to them laterally.

The practical importance gained from the above is that whenever there is any difference in size, shape or contour of the liver, if not due to acquired disease, one should look for additional malformations or developmental anomalies in the biliary passages or in the pancreas.

SUMMARY

1. A case of congenital absence of the gall-bladder, cystic and common duct together with an absence of the left lobe of the liver is reported.

2. Conclusive evidence of a compensatory dilatation of ducts in the absence of a gall-bladder was wanting.

3. Normal liver function is apparently maintained in a percentage of individuals with no gall-bladder and a diminished amount of liver tissue.

4. On observing any variations from normal in size, shape or contour of the liver at operation or autopsy, a careful investigation should be made for developmental anomalies of the gall-bladder and pancreas.

ABSTRACTS OF REPORTED CASES OF ABSENCE OF THE GALL-BLADDER

Reporter, Arnissat; year, 1831; age, 24; sex, F.; jaundice, no; cause of death, abdominal chest disease; operated, no; liver—pathology, n.m.; liver—fissure, n.m.; gall-bladder, none; duct—cystic, yes; duct—common, yes; duct—hepatic, no; pancreas, spleen three times normal size, many supp. nodules. Rev. Med. Franc. et Etrangier, vol. xi, p. 148, 1831.

Reporter, Baker; year, 1835; age, n.m.; sex, n.m.; jaundice, n.m.; cause of death, supp. process; operated, no; liver—pathology, n.m.; liver—fissure, present; gall-bladder, none; duct—cystic, n.m.; duct—common, n.m.; duct—hepatic, n.m.; pancreas, n.m. N. A. Archives of Medicine and Surgical Science, February, 1835, vol. i, No. 5, p. 307.

Reporter, Bednar; year, 1850; age, six days; sex, M.; jaundice, n.m.; cause of death, encephal.; operated, no; liver—pathology, no kidney; gall-bladder, no; duct—cystic, n.m.; duct—common, n.m.; duct—hepatic, n.m.; pancreas, n.m. Ksh. der neugeb u. Sauglmze, vol. iii, p. 139, 1850.

Reporter, Bergman; year, 1836; age, 60; sex, F.; jaundice, n.m.; cause of death, insane, inf., coma; operated, no; liver—pathology, enlarged; liver—fissure, present, gall-bladder, replaced by small fibrous mass; duct—common, no; duct—hepatic, yes; pancreas, n.m. Hannoversche annalen fur die gesammite Heilkinde, B. i, p. 552, 1836.

Reporter, Blakeway; year, 1912,; age, newly born; sex, n.m.; jaundice, n.m.; cause of death, n.m.; operated, no; liver—pathology, n.m.; liver—fissure, n.m.; gall-bladder, no; duct—cystic, n.m.; duct—common, n.m.; duct—hepatic, n.m.; pancreas, not developed cauda and corpus.

Reporter, Boulet; year, 1772; age, n.m.; sex, n.m.; jaundice, n.m.; cause of death, n.m.; operated, n.m.; liver—pathology, n.m.; liver—fissure, n.m.; gall-bladder, n.m.; duct—cystic, n.m.; duct—common, n.m.; duct—hepatic, n.m. Comm. de Rebus in Scientia naturale et medicine gestis, vol. xviii, p. 244, 1772, out of Pouppe de portia Historie des Maladies de S. Donnique, vol. ii.

Reporter, Brande; year, 1816; age, three days; sex, n.m.; jaundice, n.m.; cause of death, n.m.; operated, no; liver—pathology, n.m.; liver—fissure, n.m.; gall-bladder, none; duct—cystic, yes; duct—common, yes; duct—hepatic, n.m.; pancreas, n.m. Mechels Arch. G. d. Physiologie, 1816, p. 249.

Reporter, Bubenhofer; year, 1905; age, 66; sex, M.; jaundice, none; cause of death, cardiac failure; operated, no; liver—pathology, cirrhotic and small; liver—fissure, none; gall-bladder, none; duct—cystic, no; duct—common, 9 mm. lumen fill free; duct—hepatic, two very large, empty, collapsed. Ueber emen Fall von Kougentalein Defest (Angensie der Gallenblase Anat. Hefte Wiesb., 1905, vol. xxvii, p. 305.

Reporter, Buddy; year, 1923; age, 28; sex, M.; jaundice, yes; cause of death, accident fractured spine, int. hem.; operated, yes, died fourteen days, hem. hepato lig.; liver—pathology, evidence inf. no scar formation; liver—fissure, barely indicated; gall-bladder, very rudimentary; duct—cystic, n.m.; duct—common, n.m.; duct—hepatic, yes; pancreas, case of checked development of the gall-bladder. Uber gangeborne Gallenblase Verkumerung Arch. F. Klin. Chir., Berl., 1923, vol. cxxvi, pp. 45–47.

Reporter, Buttner; year, 1769; age, misshapen fetus; jaundice, n.m.; cause of death, n.m.; operated, n.m.; gall-bladder, n.m.; duct—cystic, n.m.; duct—common, n.m.; duct—hepatic, n.m.; pancreas, n.m. Anatom. Wahrnehmungen, Lpz., 1769, p. 124.

Reporter, Campbell. Thompson, John Edin. Med. Jour., vol. xxxvii, p. 728, pt. ii.

Reporter, Choloneley; year, 1820; age, five weeks; sex, n.m.; jaundice, yes; cause of death, convulsions; operated, no; liver—pathology, normal; liver—fissure, present; gall-bladder, cord; duct—cystic, directly into liver; pancreas, enlarged, indurated. Med. Trans. of Coll. of Phys. of Lond., 1820, vol. vi, p. 50.

Reporter, Canton; year, 1847; age, 65; sex, F.; jaundice, n.m.; cause of death, n.m.; operated, no; liver—pathology, n.m.; liver—fissure, shallow groove; gall-bladder, no; duct—cystic, cystic artery absent; duct—common, two times normal size; duct—hepatic, dilated; pancreas, n.m. Lancet, 1847, vol. xi, p. 406.

Reporter, Droste; year, 1853; age, 74; sex, F.; jaundice, n.m.; cause of death, pulmonary disease; operated, n.m.; liver—pathology, atrophic; liver—fissure, no; gall-bladder, no; duct—cystic, n.m.; duct—common, n.m.; duct—hepatic, n.m.; pancreas, n.m. Deutche Klinik, vol. iii, p. 305, 1853.

Reporter, Eiben; year, 1910; age, 48; sex, M.; jaundice, n.m.; cause of death, pneumonia; operated, n.m.; liver—pathology, normal; liver—fissure, no; gall-bladder, no;

duct—cystic, no—union of two hepatic ducts into one passage, no dilation; pancreas, normal. In. Diss. Giessen, 1910.

Reporter, Elvert; year, 1780; age, adult; sex, M.; jaundice, yes; cause of death, n.m.; operated, n.m.; liver—pathology, n.m.; liver—fissure, no; gall-bladder, no; duct—cystic, n.m.; duct—common, n.m.; duct—hepatic, n.m.; pancreas, n.m. Diss. Praeside C. F. Jaeger. Tubigen, 1780.

Reporter, Emery L. Bergman; year, 1701; age, n.m.; sex, n.m.; jaundice, n.m.; cause of death, n.m.; operated, no; liver—pathology, two lobes not separated; liver—fissure, no; gall-bladder, no; duct—cystic, numerous small ducts; pancreas, n.m. Mem. de l'Acad. dis. Sci., 1701.

Reporter, Enopf; year, 1891; age, eight weeks; sex, n.m.; jaundice, yes; cause of death, inanition; operated, n.m.; liver—pathology, icteric enl., proliferations as in hered. syph.; liver—fissure, n.m.; gall-bladder, no; duct—cystic, no; duct—common, no; duct—hepatic, no; pancreas, normal. Muench Med. Wchnochr, vol. xxxviii, p. 283, 1891.

Reporter, Enopf; age, six months; sex, n.m.; jaundice, yes; cause of death, Br. catarrhal; operated, n.m.; liver—pathology, enlarged, lobes adherent, cells colorless; liver—fissure, no; gall-bladder, no, only loose connective tissue; pancreas, hard and thick. Muench Med. Wchnochr, vol. xxxviii, p. 283, 1891.

Reporter, Enopf; age, three months; sex, F.; jaundice, n.m.; cause of death, catar. pn. miliary tb.; operated, n.m.; liver—pathology, normal; liver—fissure, n.m.; gall-bladder, no; duct—cystic, two hepatic ducts uniting to D. choledochus; pancreas, n.m. Muench Med. Wchnochr, vol. xxxviii, p. 283, 1891.

Reporter, Eshner; year, 1894; age, two months; sex, n.m.; jaundice, no; cause of death, broncho-pneu.; operated, no; liver—pathology, normal; liver—fissure, no; gall-bladder, no; no ducts; pancreas, n.m. Medical News, 1894.

Reporter, Ewers; year, 1914; age 45; sex, F.; jaundice, n.m.; recovery; operated, exploratory appendecomy; liver—pathology, normal; liver—fissure, n.m.; gall-bladder, no; duct—cystic, no; duct—hepatic, in two hep.; pancreas, head enlarged and hard. In. Diss. Giessen, 1914.

Reporter, Follet; year, 1828; age, n.m.; sex, M.; jaundice, n.m.; cause of death, gastro-enteric; operated, n.m.; liver—pathology, n.m.; liver—fissure, no; gall-bladder, no; duct—cystic, n.m.; duct—common, n.m.; duct—hepatic, n.m.; pancreas, n.m. Rev. Med. Franc. et etrangere, vol. xi, p. 139, 1828.

Reporter, Fowler; year, 1917; age, 42; sex, F.; jaundice, yes; recovery; operated, tube in common duct; liver—pathology, n.m.; liver—fissure, n.m.; gall-bladder, no; duct—cystic, no; duct—common, yes; duct—hepatic, yes; pancreas, hard ind. Schachner, Annals of Surgery, October, 1916.

Reporter, Freund; year, 1876; age, three months; sex, M.; jaundice, yes; cause of death, marasmus; operated, n.m.; liver—pathology, cirrhosis; liver—fissure, a tube in fissure 1½ c. long, 1½ c. wide; gall-bladder, n.m.; duct—cystic, no; duct—common, no; duct—hepatic, no; pancreas, n.m. Jahrb. f. Kindersheilk, vol. ix, p. 178, 1876.

Reporter, Gaultier; year, 1829; age, 60; sex, M.; jaundice, yes; cause of death, pul. tb.; operated, no; liver—pathology, normal; liver—fissure, n.m.; gall-bladder, no; duct—cystic, directly into liver; pancreas, n.m. Jour. de Medicine Nebdomadaire, July 11, 1829, tome iv, No. 41, p. 61.

Reporter, Gay, R. J.; year, 1902; age, 27; sex, M.; jaundice, no; cause of death, endocarditis; operated, no; liver—pathology, n.m.; liver—fissure, yes; gall-bladder, small intra-hepatic; duct—cystic, yes, ind.; duct—common, yes; duct—hepatic, yes, accessory; pancreas, n.m. Tr. Clin. Path., 1902, vol. cviii, p. 113.

Reporter, Golob; year, 1927; age, 59; sex, F.; jaundice, no; recovery; operated, repair umbilical hernia; liver—pathology, n.m.; liver—fissure, n.m.; gall-bladder, no; duct—cystic, n.m.; duct—common, n.m.; duct—hepatic, n.m.; pancreas, n.m. J. A. M. A., vol. lxxxix, p. 692, August, 1927.

Reporter, Harle, E.; year, 1856; age, 50; sex, F.; gall-bladder, no; duct—cystic, no; duct—common, n.m.; duct—hepatic, n.m.; pancreas, n.m. Lancet, vol. xi, p. 304, 1856.

Reporter, Heschl; year, 1865; age, four months; sex, n.m.; jaundice, yes; cause of death, died, age seven months, otorrhea, etc.; operated, n.m.; liver—pathology, enl.; liver—fissure, a narrow groove; gall-bladder, rudimentary, thick solid cord; duct—cystic, no dilatation; pancreas, n.m. Wien. Med. W., 1865, vol. xv, p. 493.

Reporter, Hinder; year, 1909; age, 60; sex, M.; jaundice, yes; recovery; operated, acute abdomen; liver—pathology, n.m.; liver—fissure, no; gall-bladder, no; duct—cystic, no; duct—common, yes; duct—hepatic, yes; pancreas, hard. Australia M. Gaz., Sydney, 1909, vol. xxviii, p. 435. Outcome—recovery. Previous history, qual. dyspepsia.

Reporter, Hobhouse; year, 1909; age, eight days; sex, F.; jaundice, yes; cause of death, n.m.; operated, n.m.; liver—pathology, cirrhosis, 8 oz.; liver—fissure, n.m.; gall-bladder, no; duct—cystic, no; bile secretion going on actively; duct—common, no; duct—hepatic, no. Royal Soc. Study Dis. Child., Lond., 1904, vol. v, p. 177. Emaciated—weighed nine pounds—urine milky—contained no bile salts or pigment.

Reporter, Hochsteeter; year, 1886; age, eight days; liver—pathology, right lobe large, left small; liver—fissure, 3/O–3P; gall-bladder, none; duct—cystic, yes; duct—hepatic, n.m.; pancreas, n.m. Arch. F. Anat. Phys., 1886, Anat. Abteil, p. 369.

Reporters, Hoffman and Jackson; year, 1910; age, 65; sex, F.; cause of death, pneumonia; operated, no; gall-bladder, no; duct—cystic, no; duct—common, dilated; duct—hepatic, yes, dilated. N. Y. Med. Jour., 1910, vol. xci, p. 338.

Reporter, Home, Sir E.; year, 1813; age, few months; jaundice, yes; cause of death, emanation; operated, no; gall-bladder, no; pancreas, pl. tran. Phil. Trans. Roy. Soc. London, 1813, cited by Canton.

Reporter, (Eshner) Huber; year, 1749; age, 60; sex, F.; cause of death, death po.; operated, no; liver—fissure, n.m.; gall-bladder, none; duct—cystic, abnormally large, villus usual sit.; pancreas, biliary ducts enlarged. Phila. Trans. Roy. Soc. London, 1744–1749, vol. ix, R649, 1809.

Reporter, Kehr; year, 1913; age, adult; sex, M.; jaundice, n.m.; cause of death, n.m.; operated, n.m.; gall-bladder, none; duct—cystic, with stones; duct—hepatic, palpated. Berlin Klin. Wchnschr, 1913, vol. l, p. 5111.

Reporters, Kirmisson and Herbert; year, 1903; age, one month; cause of death, pulmonary; operated, no; liver—fissure, atrophic; gall-bladder, none; duct—cystic, none; duct—common, none; duct—hepatic, none. Bull. et mem. de la Soc. Anat. de Par., 1903, vol. lxxvii, p. 317.

Reporter, Knox; year, 1744; age, 60; sex, F.; jaundice, n.m.; cause of death, n.m.; operated, n.m.; liver—pathology, n.m.; liver—fissure, n.m.; gall-bladder, no; duct—cystic, n.m.; duct—common, n.m.; duct—hepatic, much dilated; pancreas, n.m. Phila. Trans. Roy. Soc. London, 1744, vol. ix, p. 649.

Reporter, Lenain, B.; year, 1853; age, 74; sex, F.; cause of death, pulm. dis.; operated, no; gall-bladder, no; duct—cystic, no; duct—common, yes; duct—hepatic, no. Deusche Kliniks, vol. v, p. 305, 1853.

Reporter, Lennander, K. G.; year, 1893; age, 40; sex, F.; jaundice, after op.; cause of death, escape of bile four days after op.; operated, yes, died; duct—cystic, none; duct—common, yes; duct—hepatic, all very narrow. Wein. Klin. Wchs. Ojalry, p. 710, 1893. Death due to bile leakage in peritoneal cavity—operator cut common duct.

Reporter, Loreta; year, 1888; age, 40; sex, F.; gall-bladder, none; duct—cystic, none; duct—common, n.m.; duct—hepatic, n.m. Riforma Med. Anno, vol. iv, pp. 326–333, 1888.

Reporter, Lintz; year, 1927; liver—pathology, very large; liver—fissure, no; gall-bladder, no; duct—cystic, none; duct—common, none; duct—hepatic, none; pancreas, blood-vessels normal. Am. J. M. Sc., vol. clxxiii, p. 682, May, 1927.

Reporter, Littre; year, 1705; age, nine days; operated, no; liver—pathology, normal; gall-bladder, none; duct—cystic, none. Hist. de l'acad. des sciences, 1705, p. 53.

Reporters, Eshner and Lynche; year, 1875; age, 11 months; jaundice, yes; operated, no; liver—pathology, large; liver—fissure, n.m.; gall-bladder, no; duct—cystic, large; duct—hepatic, small; pancreas, n.m. Medical Press and Circular, 1875, N.S., vol. xx, p. 362.

Reporter, Montault; year, 1829; sex, M.; cause of death, carcinoma, pylorus; liver—pathology, atrophic; gall-bladder, no; duct—cystic, none. Bull. de la Soc. Nat. d Paris 4 amee, p. 70, 1829.

Reporter, Naegeli; year, 1921; age, 65; sex, F.; operated, yes, liver—pathology, cirrhotic; liver—fissure, none; gall-bladder, none; duct—cystic, none. Virchows Arch. of Path. Anat. Berl., 1921, p. 179.

Reporter, Naegeli; year, 1921; age, 34; sex, F.; jaundice, yes; operated, yes, drainage; liver—pathology, right lobe atrophic; gall-bladder, cord-like formation contained bile; duct—cystic, rone; duct—common, dilated; duct—hepatic, gall-stone. Virchows Arch. of Path. Anat., Berl., 1921, p. 179.

Reporter, Patterson; year, 1864; age, 35; sex, M.; cause of death, asthma; operated, no; liver—pathology, four times normal size; gall-bladder, none; duct—cystic, no; duct—common, no; duct—hepatic, no; pancreas, n.m. Medical Times and Gazette, 1864, vol. xi, p. 476.

Reporter, Pozzi; year, 1872; age, monster; born dead; gall-bladder, no; duct—cystic, no; duct—common, no; duct—hepatic, no; pancreas, n.m. Bull. et Mem. de la Soc. Anat. de Par., 1872, vol. xlvii, p. 90.

Reporter, August Schachner; year, 1916; age, two; cause of death, syphilitic; liver—pathology, normal size; liver—fissure, no; gall-bladder, no; duct—cystic, n.m.; duct—common, n.m.; duct—hepatic, n.m.; pancreas, n.m. Annals of Surgery, 1916, vol. lxiv, pp. 419–433.

Reporters, Eshner and Simpson; year, 1861; age, six weeks; cause of death, peritonitis; operated, no; liver—pathology, Spigelian and quadrate lobes absent; liver—fissure, no; gall-bladder, no; duct—cystic, no; duct—common, yes; duct—hepatic, no; pancreas, n.m. Edinburgh Med. Jour., 1861, vol. vi, Part 11, p. 1045.

Reporter, Skorinin; year, 1902; age, seven weeks; sex, M.; jaundice, n.m.; cause of death, broncho pneu.; operated, no; liver—pathology, enlarged; gall-bladder, quill-like cord; duct—cystic, most of chole. obliterated; pancreas, n.m. In. Diss. Berlin, 1902.

Reporter, Sands; year, 1865; age, 20; sex M.; jaundice, n.m.; cause of death, n.m.; operated, no; liver—pathology, liver small, quadrate lobe missing; liver—fissure, no; gall-bladder, no; duct—cystic, indefinite; pancreas, n.m. N. Y. Med. Jour., June, 1865, vol. i, p. 222.

Reporters, Raybault and Shachinam; year, 1882; sex, n.m.; jaundice, n.m.; cause of death, n.m.; operated, n.m.; liver—pathology, liver small; liver—fissure, yes; gall-bladder, no; duct—cystic, n.m.; duct—hepatic, normal; pancreas, n.m. Reported by Ershner.

Reporter, Stone; year, 1908; age, 54; sex, F.; jaundice, yes; recovery; operated, choledocotomy; liver—pathology, n.m.; liver—fissure, n.m.; gall-bladder, no; duct—cystic, no; duct—common, yes; duct—hepatic, yes, dilated; pancreas, n.m. Amer. Jour. Med. Science, Phila., 1908, vol. cxxxv, p. 889.

Reporter, Stamm; year, 1916; age, 11 weeks; sex, M.; jaundice, yes; cause of death, gastro-intestinal broncho-pneu.; operated, autopsy; liver—pathology, enlarged; liver—fissure, thick, solid connective tissue band; gall-bladder, no; duct—cystic, no; duct—common, no; duct—hepatic, no; pancreas, soft, not enlarged, spleen enlarged. Felilen der grossen Gallen.

Reporters, Targiom and Tozzetti; year, 1756; age, n.m.; sex, n.m.; jaundice, n.m.; cause of death, n.m.; operated, n.m.; liver—pathology, no; liver—fissure, n.m.; gall-bladder, no; duct—cystic, no; duct—common, large; duct—hepatic, large, united with

panc. duct; pancreas, n.m. Recueil Period d Observ de Med. Par. b. Vandermonde, vol. x, p. 280, Paris, 1756.

Reporter, Theodor; year, 1908; age, six weeks; sex, M.; jaundice, yes; death, eight days after operation, from wrong feeding; operated, hepato-cholangio-enterectomy at six weeks successful; liver—pathology, cirrhosis; liver—fissure, disproportionate; gall-bladder, no; duct—cystic, no; duct—common, yes; duct—hepatic, yes; pancreas, head of pancreas missing. Arch. of Kinderheilk, vol. xlix, p. 358, 1908–1909.

Reporter, Thomas; year, 1848; age, five months; sex, n.m.; jaundice, yes; cause of death, ascites amascara; operated, no; liver—pathology, 14 oz., no fat ih liver bed cells; liver—fissure, no; gall-bladder, no; duct—cystic, no; duct—common, no; duct—hepatic, no; pancreas, n.m. Medical Times, July, 1848, vol. xvii, No. 458, p. 171.

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Reporter, Wueesche; year, 1875; age, six days; sex, M.; cause of death, starvation; operated, n.m.; liver—pathology, normal; liver—fissure, n.m.; gall-bladder, no, other anomalies; duct—cystic, greatly dilated; duct—hepatic, breadth of finger opened into duodenum; pancreas, H. W. S. 2 cm. Jahrb. F. Kinderheilk, vol. viii, p. 367, 1875.

LYMPHOID HYPERPLASIA OF LACRYMAL AND SALIVARY GLANDS

MIKULICZ' DISEASE

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In 1888,[1] Mikulicz described a symmetrical enlargement of the lacrymal and salivary glands, the glandular tissue of which had been almost entirely replaced by lymphoid tissue. This process, however, apparently was not a part of a generalized disease of lymphoid tissue. Since that time, there have been reported about 100 instances of similar symmetrical enlargement of these glands without alteration of the blood, without generalized enlargement of the lymph-nodes, without splenic enlargement, and without apparent systemic disease.

In view of the relatively infrequent occurrence of the so-called Mikulicz' disease, it seems quite worth-while to report another, especially since the changes in the tissues were not recognized, at first, as those of Mikulicz' disease and were confused with carcinoma.

Case History.—Mrs. G. L., age sixty-two years, a housewife, entered St. Mary's Hospital, Wausau, Wisconsin, August 4, 1924, complaining of swellings in front of and below the ears and of periodic dryness of the mouth.

The trouble began one year before with a sudden pain in front of the right ear, which came on while eating, and was followed by the appearance of a nodule, the size of a walnut, below the right ear. This nodule decreased in size several times; but finally became progressively larger, especially during the four months before entering the hospital. In the meantime, swellings had appeared in front of and below the left ear.

She had been married for ten years with no pregnancies. She had had scarlet fever and diphtheria in early childhood. Some difficulty in swallowing remained after the latter disease. She always had been troubled with frequent attacks of tonsillitis.

Physical Examination.—The patient is a rather obese, white woman with gray hair. She is mentally alert and physically active.

There is a flattened, dense, fairly well circumscribed swelling, about the size of a lemon, in front of the right ear. This mass extends caudad, forming a second portion below the right ear. There is a similar mass, the size of a pigeon-egg, in the region of the left parotid gland, and a discrete, movable nodule in the left, anterior triangle of the neck.

Swallowing and tracheal movements are free. No enlarged lymph-nodes are found and the spleen is not felt. The heart is enlarged to the left, but there is no definite murmur. The pupils, optic fundii, knee jerks, and superficial reflexes are normal. The temperature is 98.2 degrees F., the pulse rate 76 per minute, and the respiratory rate 18.

The blood has 98 per cent. hæmoglobin; 4,780,000 erythrocytes per cubic mm., and 7,000 leukocytes. In skiagrams of the chest the shadow of the heart extends almost to the left border of the thorax; and both hilus-shadows are a little denser than normal. The Wassermann reaction (blood) is negative.

Operation.—On August 5, 1924, a red, encapsulated mass was removed from the region of the left submaxillary gland (J. F. S.). The operation was followed by X-ray therapy with recession of the masses. However, in the spring of 1925 the mass on the left side reappeared, but this time was not affected by exposure to X-rays. Nevertheless, the patient felt well and had gained nine pounds in weight.

November 9, 1925, the left parotid gland and the dense, adherent, associated mass of tissue were removed (J.F.S.). Later, nodules appeared below and in front of the right ear and the mass in front of the left ear reappeared. The glandular tissue on both sides was removed by the method of Adson, July 18, 1926 (J. F. S.). The face remained symmetrical, except for a slight drooping of the upper lip, apparent only upon whistling.

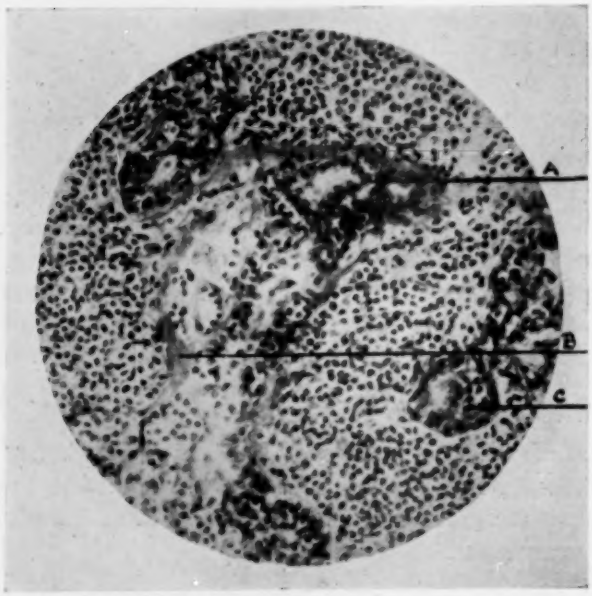

FIG. 1.—Photomicrograph of section of the left submaxillary gland. A. Duct like epithelial structure. B. Collagen. C. Duct with its normal structure destroyed by ingrowth of lymphoid tissue. (x275.)

May 9, 1927, the patient felt and appeared well. The erythrocyte count was 5,080,000 per cubic mm., the leukocyte count 7,500, and the hæmoglobin content 85 per cent. In smears of the blood there was no abnormal variation in the size, shape, or staining of the erythrocytes. Sixty-six per cent. of the leukocytes were polymorphonuclear neutrophils, 7 per cent. small lymphocytes, 19 per cent. large lymphocytes, 4 per cent. large mononuclears, and 2 per cent. eosinophils.

Tissue, removed at the first operation, was considered to be a lymph gland with metastases of an epithelial growth, which in places had a duct-like appearance. Changes in the tissue, removed at a later operation, suggested to the same observer an embryonal carcinoma, possibly from the remains of a branchial cleft.

At the suggestion of Dr. E. R. LeCount, who also examined the tissue and recognized it as the disease Mikulicz described, a more detailed study of the tissue was made by one of us (W. S. B.).

Sections of the tissue, removed at the first operation, consist of lobules of rather closely packed cells, resembling lymphocytes, distributed in which are many, variously shaped, well demarcated islands of cells (Figs. 1 and 2). Throughout the tissue, and especially about many of the cell-islands, there is considerable connective tissue which in places is rich in fibroblasts and in others consists mainly of collagen (Fig. 1,B). Here and there is distributed a moderate number of eosinophil leukocytes. Giant cells with large, clear nuclei are present but very scarce. There are some cells, somewhat larger than lymphocytes, with more basophilic cytoplasm and with the chromatin arranged as

in plasma cells. In some sections, apparently cut from the periphery of the gland, there is considerable fat. Here are a few normal ducts with normal gland-acini.

The cell-islands, which are the outstanding structures in the sections, vary in shape from almost circular to branched forms (Figs. 1 and 2). In some places their structure approximates that of normal ducts; that is, there is a definite lumen, lined by columnar cells with pale, oval nuclei (Fig. 1,A). However, for the most part their structure is in varying degrees altered by the growth of the lymphocytes and connective tissue between the cells and into the lumens (Figs. 1,C and 2). In many places the epithelial cells have undergone metaplasia, becoming squamous in type, as though from crowding by the lymphoid tissue (Fig. 2,A). In some islands there is proliferation of the epithelial cells, while in others there is little left, but masses of lymphoid tissue demarcated by connective tissue (Fig. 2).

Three neighboring cell-islands, chosen at random, were followed through thirty-eight serial sections. A wax model, constructed to scale from outline drawings of these islands, demonstrates branching, like in an orderly duct-system (Fig. 3) and therefore, establishes beyond doubt that these structures are the remains of the duct-system of the gland, which was more resistant to the destructive process than the acini.

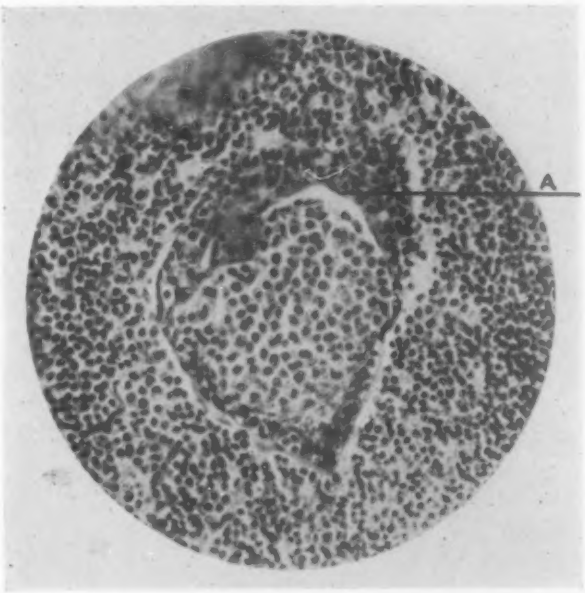

FIG. 2.—Photomicrograph of section of left submaxillary gland with a duct markedly altered by the growth of lymphoid tissue. A. Squamous epithelial cells. (x300.)

In a more detailed report of his patient in 1892[2] Mikulicz stated that the submaxillary glands were the size of a child's fist. They had lobes and lobules, like normal glands, but surfaces, made by sectioning, were pale, red-yellow, speckled with more translucent places, instead of being normally finely granular and gray-red. The substance of the gland was lardaceous and was seemingly without blood-vessels. The tissue consisted of uniformly arranged round cells, in some places thickly packed and in others with a fine reticulum. Certain larger cells had mitotic figures. Imbedded in this mass of round cells were a few acini, considerably separated.

In the glands which Tietze[3] examined no glandular tissue remained. Everywhere was lymphoid tissue with giant cells, atypical round cells, and many eosinophil leukocytes. He noted an over-growth of the capillary endothelium.

Stower[4] found chronic inflammatory changes in the glands with round cell-infiltration, giant cells, occasional eosinophil leukocytes, a few epithelioid cells, and disappearance of the normal gland-structure.

Bass [5] noted an increase in the connective tissue, which was infiltrated with small round cells and plasma cells.

Kummel [6] described substitution of the glands by lymphoid tissue with eosinophil leukocytes and giant cells.

The process was interpreted by Minelli [7] as a marked proliferation of the lymph cells already in the gland with gradual replacement by connective tissue and with mechanical destruction of the original glandular tissue. The latter process, he thought, gave rise to cysts, foreign body giant cells, and eosinophil leukocytes. He described remains of ducts and acini, which in his illustrations appear quite normal.

FIG. 3.—Wax model, constructed from outline drawings of thirty-eight serial sections, demonstrating duct-like branching of the epithelial masses.

Tissue, removed from the patient of De Wecker and Masselon,[8] led to a pathologic diagnosis of epithelial tumor, although the only epithelial structures in the accompanying illustration were normal-appearing gland-acini.

In short, the essential change in this disease has been described by all observers as a replacement of the normal glandular tissue, in whole or in part, by lymphoid tissue. For the most part, it is agreed that the glandular tissue, itself, plays entirely a passive rôle; that its destruction is due to the tremendous proliferation of the lymphoid tissue. This lymphoid replacement-tissue has varied in the descriptions from a simple proliferation of lymphocytes to a lymphoid tissue with plasma cells, eosinophil leukocytes, and giant cells, and with considerable increase in the connective tissue.

The description of the glands in this report is, therefore, essentially like those of other observers, except that structures, identified as ducts in varying stages of destruction, are described and reproduced in photomicrographs. Consequently, this report is made not merely because Mikulicz' disease is relatively rare, but mainly to describe these partly destroyed ducts, to the end that their presence need not be confusing.

Mikulicz' disease may occur at any age, but usually in early adult or middle life. Of forty-one reports, collected by Howard,[9] in which the data seemed sufficient to classify them with the so-called Mikulicz' disease, the oldest patient was seventy-seven years old, the youngest five and five-tenths, and the average age thirty-three. Twenty-six were men and fifteen were women. There was involvement of both the lacrymal and salivary glands in sixteen patients, with the first involvement of the lacrymal glands in nine, of the

salivary glands in two, and with undetermined priority in five. The lacrymal glands were involved alone in eleven patients and the salivary glands alone in fourteen. Both increase and decrease in glandular secretion were not infrequent symptoms.

Mikulicz, in his report of 1892, ventured a suggestion as to the origin of the peculiar disease. He thought that it was neither neoplastic nor related to leukæmia, because of the localization of the disease to the region of the face, the normal blood-formula, the lack of generalized lymphatic enlargement, and because, once the gland was wholly extirpated, it did not recur. He was aware that Heidenhain had found lymphoid tissue in the normal glands. Bearing in mind the remarkable and prompt response of lymphoid tissue to infecting organisms, he suggested that the disease was an infectious or parasitic one; the glandular tissue being destroyed by the excessive growth of the lymphoid tissue of the glands. He conceived of the infection beginning in the lacrymal glands, probably from the conjunctival sac, and then secondarily involving the salivary glands by way of the tear-duct, pharynx, and mouth.

Brunn [10] noted that symmetrical enlargements of the lacrymal and salivary glands involved the lacrymal glands alone, or the salivary glands alone, as well as involving both sets of glands. He found that these enlargements had been reported as unaccompanied by changes in the lymph-nodes, spleen, and blood; and that they had also been reported with enlargement of the lymph-nodes and spleen [11] and even with a leukæmic blood-formula.[12] Therefore, he concluded that the condition, described by Mikulicz, was a symptom-complex, rather than a disease-entity, and that it bore a close relationship to pseudoleukæmia and leukæmia. Many later writers have agreed with Brunn, believing that there is no definite line of division between the uncomplicated salivary and lacrymal enlargements and those occurring with pseudoleukæmia and leukæmia, that one group merges into the other, and that they probably have a common cause.

On the other hand, symmetrical enlargement of these glands has also been reported as coexistent with tuberculosis, syphilis, erythema multiforme, and epidemic encephalitis, and even has been connected with deranged function of the glands of internal secretion. However, no conclusive evidence, such as the finding of tubercle bacilli, spirochæta pallida, or other organisms in the tissue, has been presented, except by Krailsheimer,[13] who reported the discovery of numerous tubercle bacilli in the submaxillary gland, as well as tubercle-like nodules in the iris.

And furthermore, Mikulicz' disease has been classified by Ziegler [14] as an atypical form of Hodgkin's disease, similar to that form which involves the gastro-intestinal tract.

Inasmuch as the origin of lymphatic leukæmia, pseudoleukæmia, and Hodgkin's disease is entirely unknown, the attempt to connect Mikulicz' disease with them does not serve to clarify our knowledge of the nature of the disease. Then too, if there is such a close connection between all symmetrical enlargements of the lacrymal and salivary glands and these little-

understood diseases, it seems strange that such a large group with symmetrical glandular enlargement has not developed apparent signs of leukæmia, pseudoleukæmia, or Hodgkin's disease. The disease had existed for three years in Ranzi's [15] patient without change in the lymph glands or in the blood; for five years in Snell's [16] and in Berlin's [17] patients; for eight years in Kummel's [18] patient; and for twelve years in Tietze's.[19] Zondeck [20] later stated that the patient of Tietze's report had not developed change in the blood after another ten years, although the involved glands had become larger. There is no report of any patient, whose disease began as the uncomplicated one of Mikulicz, who died of that disease or as a direct result of it, except for the patient of Marcuse.[21] However, not long after the disease was noticed in this patient, the lymph glands were found to be enlarged, especially the mediastinal group, and death occurred eighteen months after the onset of the disease.

Kummel, De Wecker and Masselon, Berlin, Hahnle,[22] and Rollet [23] have noted, like Mikulicz, that there is no recurrence if the gland of Mikulicz' disease is completely removed. This is not the rule with the glandular involvements of leukæmia or Hodgkin's disease.

In view of these discrepancies, the ideas of Munck [24] seem, indeed, rational. He has called attention to the work of Chiewitz,[25] which indicates that the lymphoid tissue, found in the normal salivary or lacrymal glands, is anatomically and embryologically a part of the lymphatic system. Therefore, it is to be expected that this tissue would be subject to the diseases to which lymphoid tissue, elsewhere, is subject. Hence, it may react to various infections, including tuberculosis and syphilis, and may participate in such diseases as leukæmia, pseudoleukæmia, and Hodgkin's disease. While symmetrical enlargement of the lacrymal and salivary glands may be incidental to such diseases as leukæmia or Hodgkin's disease, or may be due to tuberculosis or syphilis, nevertheless, the original suggestion of Mikulicz may be true; that there is, indeed, a group in which the glandular enlargement is due to an infection, the organisms gaining entrance through the ducts of the glands by way of the conjunctival sac or buccal cavity. The occurrence of conjunctival, nasal, pharyngeal, or tonsillar infection, preceding the onset of the disease, has been reported by several observers [26] and may not be without significance.

If the term, Mikulicz' disease, be made to include all chronic, symmetrical enlargements of the lacrymal and salivary glands, it is evident that it cannot imply a disease-entity. Nevertheless, there seems to be a definite group of patients, like the patient of Mikulicz' report, whose disease has a long course without effect upon the general health or life of the patient, and hence, with a wholly different prognosis than that of leukæmia or Hodgkin's disease.

Summary.—Structures in the salivary glands of a patient with Mikulicz' disease are identified as ducts in various stages of destruction; are described; and are reproduced in photomicrographs.

Mikulicz' disease is essentially a disease of the lymphoid tissue of the lacrymal and salivary glands with secondary destruction of the parenchyma. It is probable that this lymphoid tissue, for the most part solitary nodes in

and about the walls of the ducts, undergoes or is subject to diseases quite like those of lymphoid tissue elsewhere in the body. A separate classification of these diseases seems unnecessary.

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THE SURGICAL PATHOLOGY OF EPIDIDYMITIS

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Although epididymitis is predominantly of gonococcus etiology, other bacteria may produce lesions clinically indistinguishable either from those of gonorrhœal origin or from those due to the tubercle bacillus. We found in a recent study of 3606 cases of epididymitis admitted to the Urological Service of Bellevue Hospital that while 3000 of this number resulted from Neisserian infection, the remainder were etiologically divided between those of tuberculosis (280) and those commonly designated as "non-specific" in origin (326). We are not concerned here with the tuberculous variety. "Non-specific" we more properly designate as non-gonorrhœal non-tuberculous since staphylococci, streptococci, colon bacilli, Friedlander bacilli and more rarely micrococci catarrhalis may be etiologically identified with the epididymitis, either individually or in combination.

Demonstration of the gonococcus in the discharge of an associated urethritis confirms the diagnosis of gonorrhœal epididymitis. Often no discharge is present which may mean (1) there is a latent gonococcus infection of the posterior urethra and adnexa (prostate and seminal vesicles) or (2) the epididymitis is non-gonorrhœal in origin. Urethral discharge may, however, contain some of the pyogenic bacteria above mentioned and no gonococci. This finding usually indicates the etiology of the lesion.

The diagnosis having been made, the patient is at once put to bed, given a cathartic, and the adhesive plaster scrotal suspensory dressing described elsewhere is applied.[1] Complete immobilization and high elevation of the scrotal contents is attained by this dressing; its equal cannot be purchased in shops. As a rule an ice cap is applied to the inflamed parts although in some cases greater relief is afforded by heat. Pain will be relieved at once in many and within twelve hours in two-thirds of these cases.[1] Those not able to sleep the second night after institution of this treatment are operated upon. For some time a persistent elevation of the temperature was our operative criterion, but we have found the persistence of pain is a more reliable surgical guide. One in fifteen of the gonorrhœal and one in four of the non-gonorrhœal non-tuberculous cases required operation. Epididymotomy is the procedure of choice, although occasionally epididymectomy and more rarely orchidectomy must be performed.

Surgical treatment of epididymitis by puncture was first employed by Velpeau.[2] Plunging a needle through the skin, multiple punctures were made in the underlying indurated mass. Immediate relief was obtained in most cases; the surgical complications of hemorrhage and infection are not

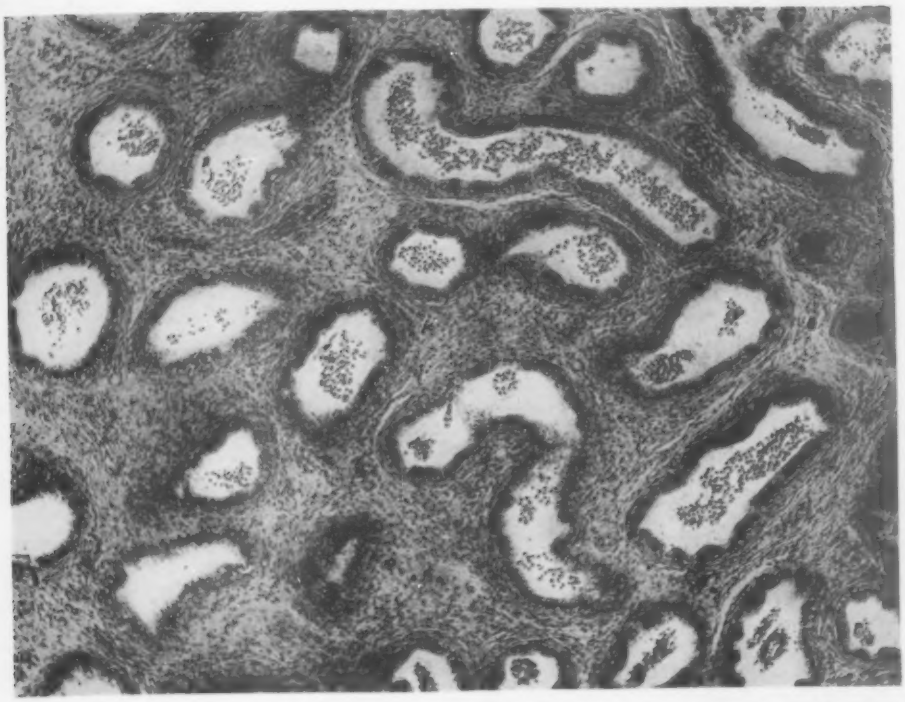

FIG. 1.—Beginning intratubular leucocytic exudation. At this stage there is but moderate cloudy swelling without loss of normal structures. Exudate is chiefly polymorphonuclear. Early interstitial infiltration is noteworthy.

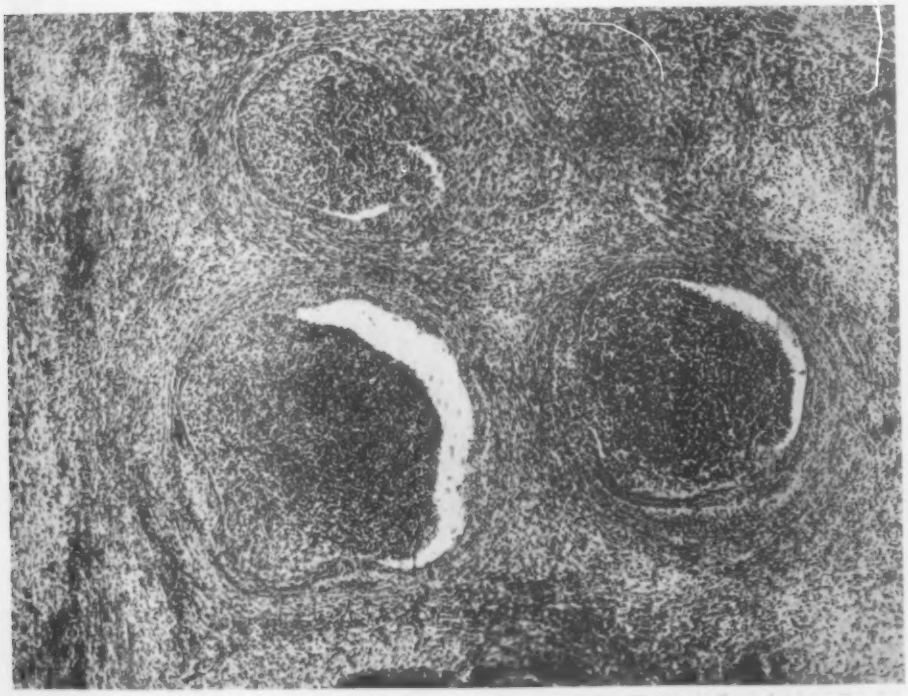

FIG. 2.—Tubular filling with rupture of basement membranes and extension into interstitial tissues. Intensification of leucocytic stroma infiltration.

recorded. Velpeau's work was subsequently warmly endorsed by de Cassis and others. Open epididymotomy, however, was first performed by Pirogoff [3] in 1852. Twelve years later and unaware of Pirogoff's work, Smith [4] recorded

TABLE I.

Age	Gc.	Non Gc.	Total
19 and under	8	1	9
20–29	159	25	184
30–39	33	25	58
40–49	5	17	22
50–59	2	8	10
60 and over	1	1	2
Not recorded	1	2	3
			288

TABLE II.

Side Involved	Gc.	Non Gc.	Total
Right	104	38	142
Left	79	35	114
Bilateral	26	6	32
			288

twenty cases of acute epididymitis in which the agonizing symptoms were at once relieved by exposure of the epididymis and multiple incisions into its substance with a sharp knife, "being careful not to incise the testicular substance." Since Smith's paper several surgeons have reported numerous epididymotomies, but it remained for Hagner [5] (1906) to demonstrate a safe and simple technic which may be unhesitatingly and universally employed. The Hagner method of epididymotomy is the routine procedure in the Bellevue Hospital Urological Clinic. Epididymectomy is performed for (1) gross destruction of the epididymis and (2) recurrence of epididymitis after epididymotomy or (3) in some cases after repeated attacks without operation. Diffusely cystic and some otherwise grossly diseased epididymes have at times been removed.

Of 3326 cases of non-tuberculous epididymitis studied by us, 209 of the gonorrhœal and seventy-nine of the non-gonorrhœal cases were operated upon. Epididymotomy was performed a total of 200 times. Epididymectomy primary or secondary was the procedure in seventy-four, and orchidectomy for abscess in thirty-five cases (Table III), a total of 309 operative procedures on 288 patients. Sometimes the epididymis and testicle were removed en masse. From these operations seventy-six surgical specimens have been available for study and constitute the basis for our discussion of the histopathology.

All chronically inflamed and most subacutely inflamed epididymes may be removed under local anæsthesia (fifty-eight times). Manipulation of the

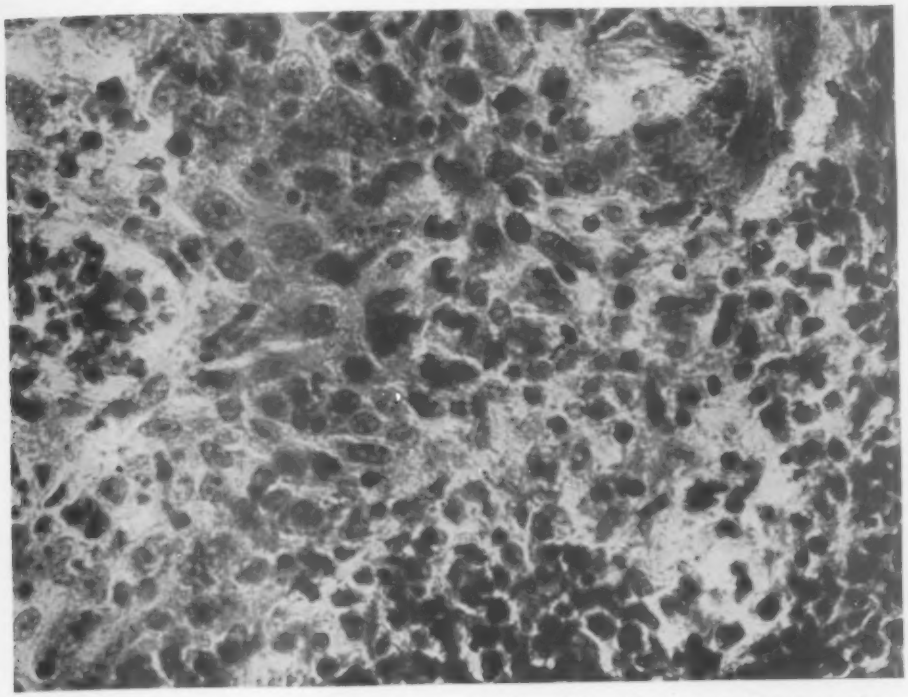

FIG. 3.—Character of early cellular exudate in wall of a tubule. Of particular interest are the numerous plasma cells and large mononuclears.

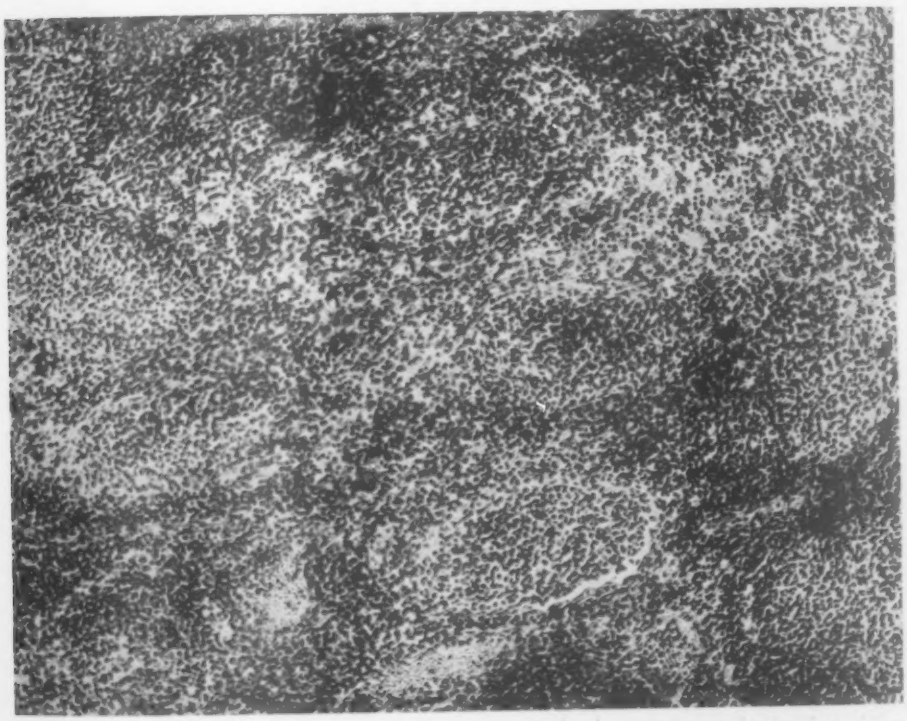

FIG. 4.—Later stage of Fig. 2. The location of former tubules is suggested by lighter areas in suppurative mass.

TABLE III.

Type of Operation	Gc.	Non Gc.	Total
Epididymotomy	178	22	200
Epididymectomy:			
Primary	24	45	69
Secondary to Epididymotomy	3	2	5
Orchidectomy			
Primary	5	16	21
After:			
Epididymotomy	5	7	12
Epididymectomy	1	1	2

acutely involved organ is often painful even after novocain infiltration, and in this group the administration of a general anæsthesia has been our procedure of choice (170 times). In seven cases spinal anæsthesia was used with entire success and in the hands of one skilled in its use, is the ideal anæsthesia.

The scrotum about to be incised is tense and shiny if the process is acute. Certain areas with underlying gross abscess may be glazen in appearance. Scrotal œdema adds greatly to the size of the inflammatory mass. If the lesion is subacute or chronic, integumentary changes may be absent or those of mild injection and œdema.

Usually the tunica vaginalis is thickened, indurated and when incised releases a variable quantity of hydrocele fluid, the formation of which results from inflammatory irritation of the serous membrane. Exudation was recorded as present in 101 of the operated cases. Clear or cloudy fluid was noted to be present in sixty-eight, the quantity varying from 5 c.c. to four ounces. When the process is acute, fibrin is usually found. We observed it in amounts of one dram to three ounces twelve times. Occasionally organized fibrin will add great palpable solidity to the mass, and was found in four instances. Serosanguineous fluid is occasionally encountered, as is free pus. (Table IV.) If the lesion has been present for some days or if there

TABLE IV.

Hydrocele Present	Gc.+	Gc.—	Total
Fluid 1 dram to 8 ounces	53	15	68
Fibrin 1 dram to 3 ounces	8	4	12
Fibrin (organized) ½ oz. to 1½ oz.	4	..	4
Serosanguineous fluid	4	2	6
Free pus in tunica vaginalis	6	5	11
			101

has been antecedent inflammation, adhesions may firmly bind the tunica vaginalis to the epididymis and testicle or may tenaciously unite the testicle and epididymis in a solid mass. Furthermore, if the epididymitis is a recurrent

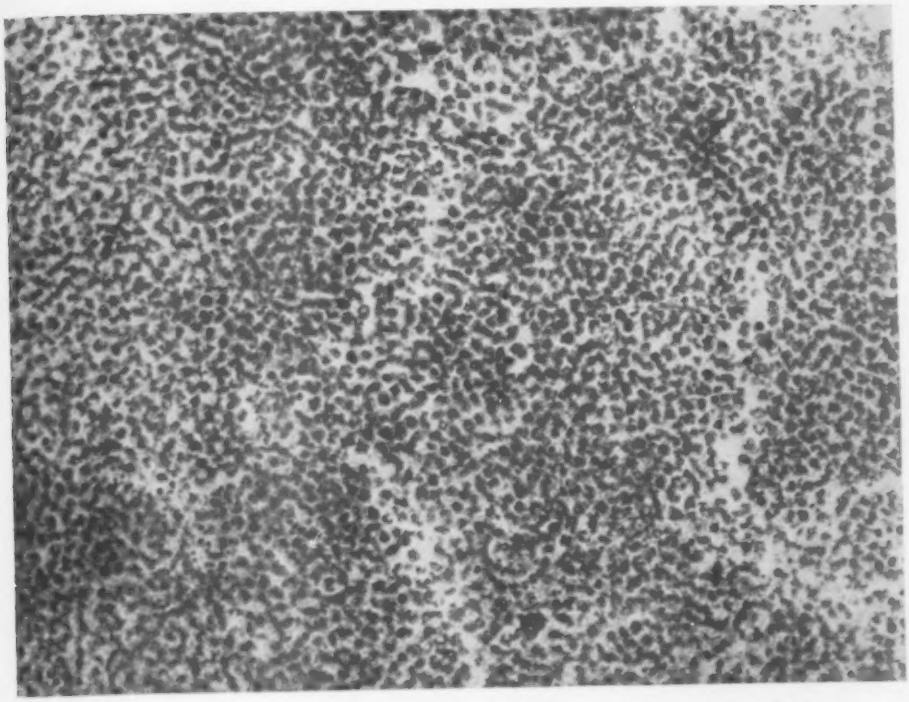

FIG. 5.—Massive necrosis of epididymis. No landmarks. A later stage of Fig. 4.

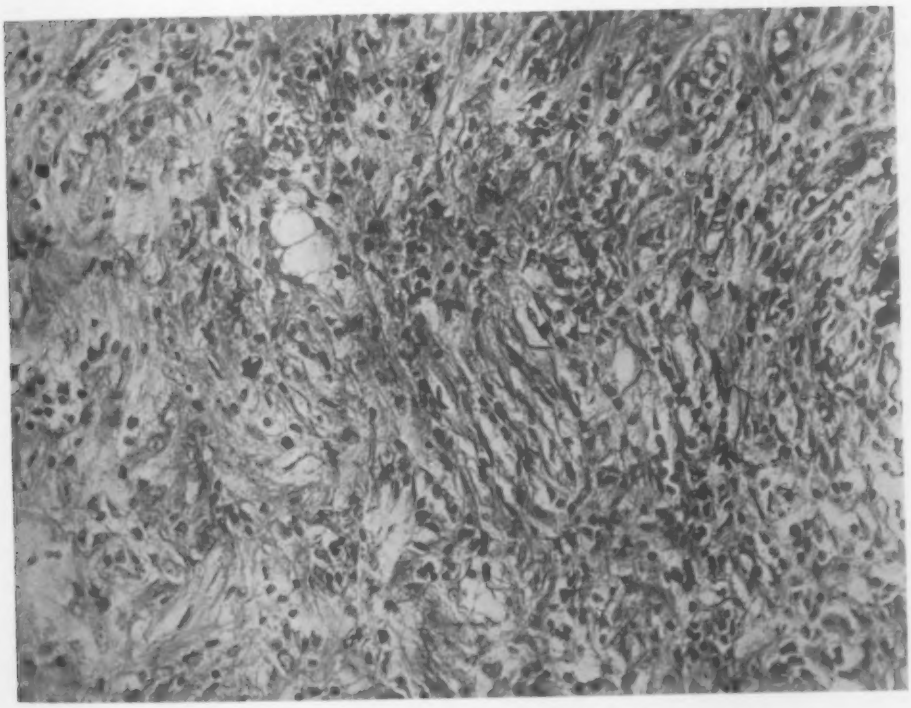

FIG. 6.—Œdematous infiltration of stroma of epididymis with vacuolization.

attack, cystic degeneration of the organ is frequently observed. While probably of greater incidence, cystic changes were noted five times in this series. Inflammation of the tunica vaginalis is proportional to the severity of the attack. The membrane may be either velvety-red or pallid. Coexisting injection of the tunica albuginea may be observed, but the testicle is not involved except secondarily by (1) extension of an epididymis abscess or (2) by thrombosis of the lower spermatic cord with trophic gangrenous orchitis.

The anatomical progression of the infection from the posterior urethra, prostate, and seminal vesicles down the vas deferens explains the greater incidence and increased severity of globus minor involvement. That transmission of infection is unquestionably by the vas and its mural lymphatics has been clinically demonstrated by vasectomy. Prior to 1925, 30 per cent. of our prostatics at Bellevue developed acute epididymitis at some stage of their hospitalization, usually post-operatively. Two years ago routine vasectomy (ligation with resection of 1 cm. of vas) was instituted, and since then this type of epididymitis has occurred but twice. Metastatic pyogenic blood borne infection of the epididymis has been observed but is rare. We have seen it associated with influenza, pneumonia, and acute tonsillitis each in one case.

Gross examination and incision of the exposed epididymis clearly indicates that the lesion is nearly always most acute in the globus minor. It may be limited to this part, but extension to the globus major or head usually occurs with the formation of numerous punctate abscesses. Frequently by coalescence of these abscesses the entire organ is converted into a suppurating mass and by extension, secondary destruction of the testicle may ensue. (Table V.)

TABLE V.

Gross Surgical Pathology.

	Abscess			Inflammation					
				Acute			Chronic		
	GC.+	GC.–	Total	GC.+	GC.–	Total	GC.+	GC.–	Total
Epididymis :									
Head	26	5	31	21	1	22	..	..	..
Body	12	4	16	1	1	2	..	..	..
Tail	41	12	53	8	11	19	..	1	1
Universal	23	8	31	67	27	94	..	2	2
Cord	..	1	..	..	..	..	..	..	..
Vas	3	1	4	2	..	2	..	..	..
Testicle	4	8	12	..	..	..	..	..	..
Present (location Not recorded)..	90	..	..	105	..	..	..	..	..

It is to be noted, moreover, that gross suppuration requiring surgical liberation is observed four times more frequently in the non-gonorrhœal than in the gonorrhœal cases, and the incidence of secondary suppurative orchitis is

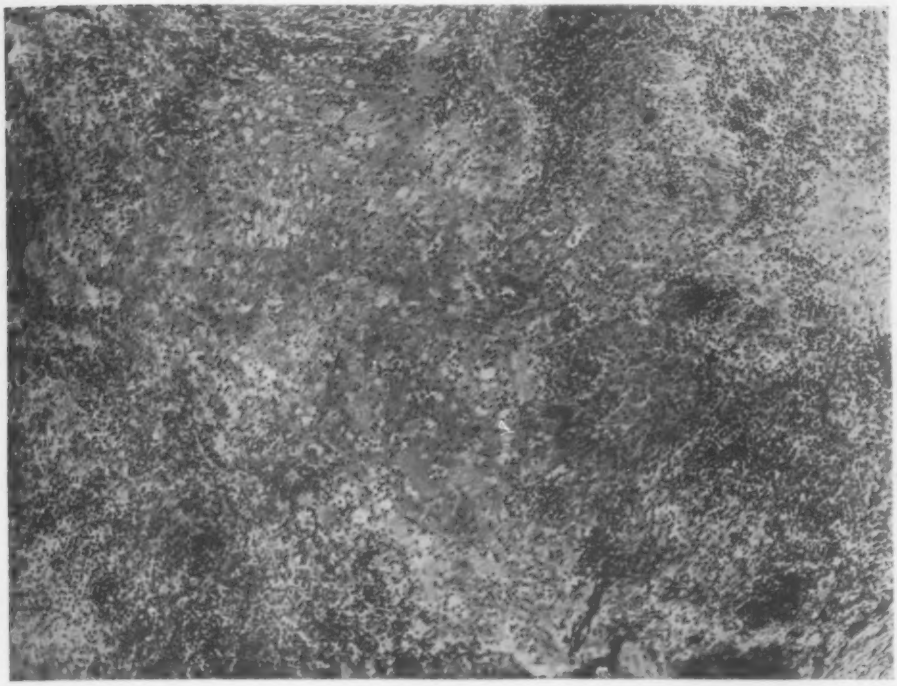

FIG. 7.—Hyalin degeneration with vacuolization. Generalized leucocytic infiltration.

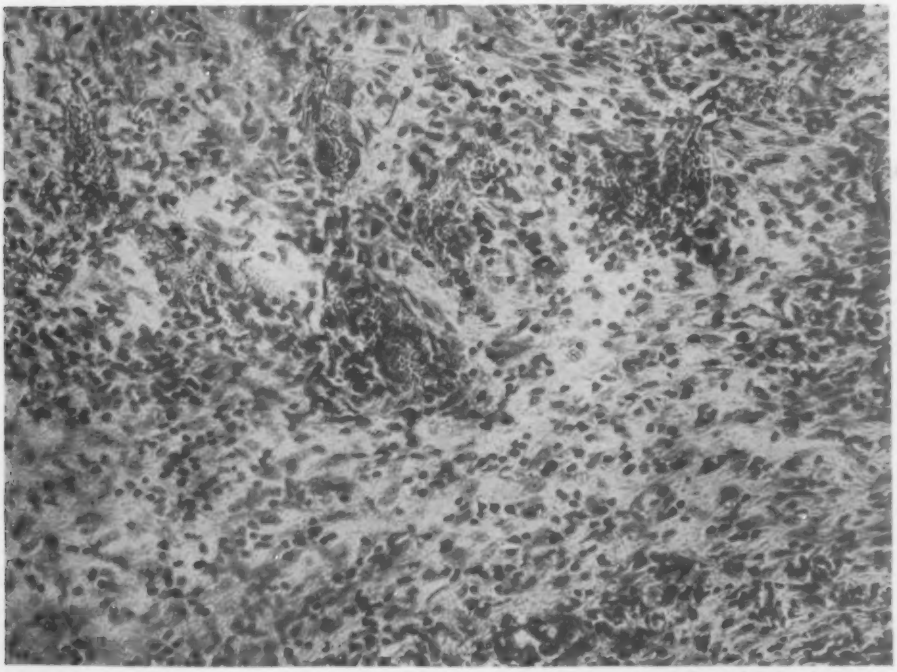

FIG. 8.—Repair process. Particularly about the margins of necrotic areas do innumerable capillary sprouts of young connective tissue push their way into the resolving debris.

proportionately higher. On the other hand, a surprising number of epididymes shows only moderate inflammatory involvement with great pain and without gross pus. Examination of the serosanguineous fluid obtained on puncture of these organs reveals myriads of leucocytes and indicates a mild degree of suppuration, a constant histological finding in early acute lesions.

The pathological histology of gonococcus and non-gonorrhœal non-tuberculous epididymitis is identical with this exception—resolution is somewhat slower in the gonococcal variety. In each type, however, a definite inflammatory cycle is observed, the changes noted histologically as well as grossly depending on the virulence of the attack and to a lesser degree on the tissue resistance of the host and the treatment employed. These inflammatory processes we broadly classify as acute and chronic. The primary phase of the acute inflammation is exudative or catarrhal; the second phase is suppurative or necrotic. Chronic inflammations are suppurative or, if the repair process is well under way, proliferative. It must be borne in mind that an inflamed organ may show microscopically several stages of inflammation, exudation or necrosis in some parts with repair and sclerosis elsewhere. On the other hand, in each specimen there is usually a predominant process, and the various epididymes studied by us have been classified according to this prevalent inflammatory picture. (Table VI.) It is interesting to note the increased

TABLE VI.

*Pathologic Histology.**

Specimens available for study Gc.+ 22 Gc.— 54; Total 76			
Acute	Gc.+	Gc.—	Total
Exudative	4	4	8
Suppurative	13	25	38
Chronic			
Suppurative	4	13	17
Proliferative	1	12	13
			76

* Tabulated according to the predominant histological picture. In some tissues, all of the above stages may be recognized, more particularly among those removed from cases of recurrent epididymitis.

incidence of the chronic inflammatory phase in the non-gonorrhœal non-tuberculous group. Unquestionably the absence of venereal infection misleads these patients into a misconception of the severity of their respective lesions and treatment is postponed until prolonged pain and fever is no longer tolerable, or the appearance of signs of gross suppuration, possibly with sinus formation, arrests the attention.

HISTOPATHOLOGY

Of the important histopathological contributions concerning epididymitis perhaps the earliest is that of Scheperlern who, in 1871, first pointed out the destruction of the walls of the ductus epididymis by lymphocytic infiltration with periductal invasion by leucocytes. In 1903, Audry and Dalou described

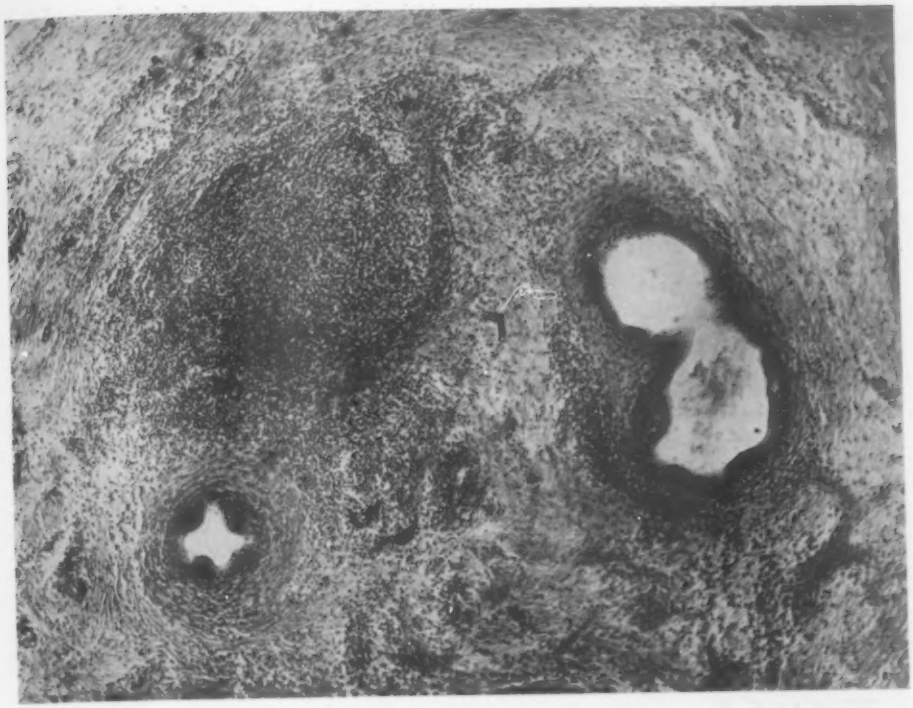

FIG. 9.—Peritubular and interstitial sclerosis with persisting tubular abscess. The ultimate conversion of such an abscess into scar is indicated in Fig. 10.

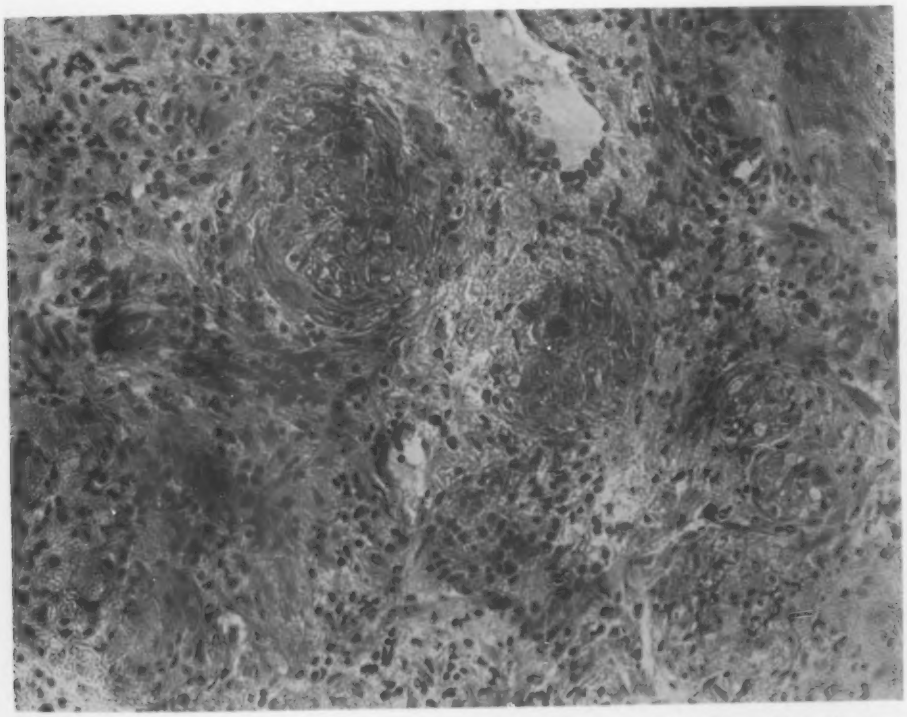

FIG. 10.—Replacement of inflamed tubules by scar. Sclerotic end result of many tubular abscesses. Cause of sterility apparent.

the formation of tubular abscesses, the infectious invasion of the interstitial tissue and lymphatics, and certain phases of tubular repair. Berman (1905) first demonstrated gonococci in acute lesions and since then others have described various tissue changes in both acute and chronic epididymitis.

Acute Epididymitis.—At the onset of the inflammation the process is that pathologically designated as acute catarrhal or exudative. There is cloudy swelling and desquamation of the cylindrical epithelium lining the tubules. This is at once followed by both intratubular and interstitial infiltration with polymorphonuclears, plasma cells, lymphocytes, large mononuclears and a variable degree of œdema. (Fig. 1.) As the inflammation becomes progressively more intense, the leucocytic and œdematous infiltration increases and the underlying vascular changes become pronounced. Enormous acute congestion with massive diapedesis of red blood-cells into the surrounding tissues is seen. While this destructive process is taking place, the phenomenon of vascular repair is well under way and about the periphery of the numerous focal lesions capillary sprouts of young connective tissue push their way into the destroyed tissues. This has been seen within thirty hours after acute onset of the disease.

The transition from the acute catarrhal or exudative stage to that of suppuration is indeed rapid and overlapping; no academic line of demarcation can be drawn. Before the initial process is well begun, microscopic focal abscesses (Fig. 2) are evident in the globus minor, so that within forty-eight hours grossly discernible abscesses may be formed by the confluence of several of the smaller. Hence, the majority of acutely inflamed epididymes removed at operation will present histologically, if not grossly, the picture of massive suppuration with generalized tubular destruction and loss of most of the normal landmarks.

Bringing about this picture of gross destruction are certain minute histological changes. With marked infiltration and engorgement of the tubules with leucocytes, the basement membranes are ruptured early and the mass becomes a focal abscess. Leucocytic infiltration is predominantly polymorphonuclear at first, but in some cases the lymphocytes outnumber these cells. Large mononuclear cells appear early and may be numerous. (Fig. 3.) They are best observed within the lumen of the tubules. Œdema is generalized, most pronounced where the inflammatory battle is most severe and gives rise to the characterisitic picture of tissue vacuolization—the fluid infiltration of the stroma. (Fig. 6.) Fibrin appears first in the periphery and may later show organization. In two-thirds of the specimens from acute cases we observed hyalin degeneration. (Fig. 7.) Eosinophiles are commonly seen in unusual numbers. Kretschmer and Alexander[2] noted an increased cell count of eosinophiles in the blood in some of their patients. We did not observe this alteration in the circulating blood, although the increased presence of these cells locally was often notable.

Chronic Epididymitis.—As the transition from the acute to the chronic stage is a matter of clinical relativity, so, histologically, does the picture of

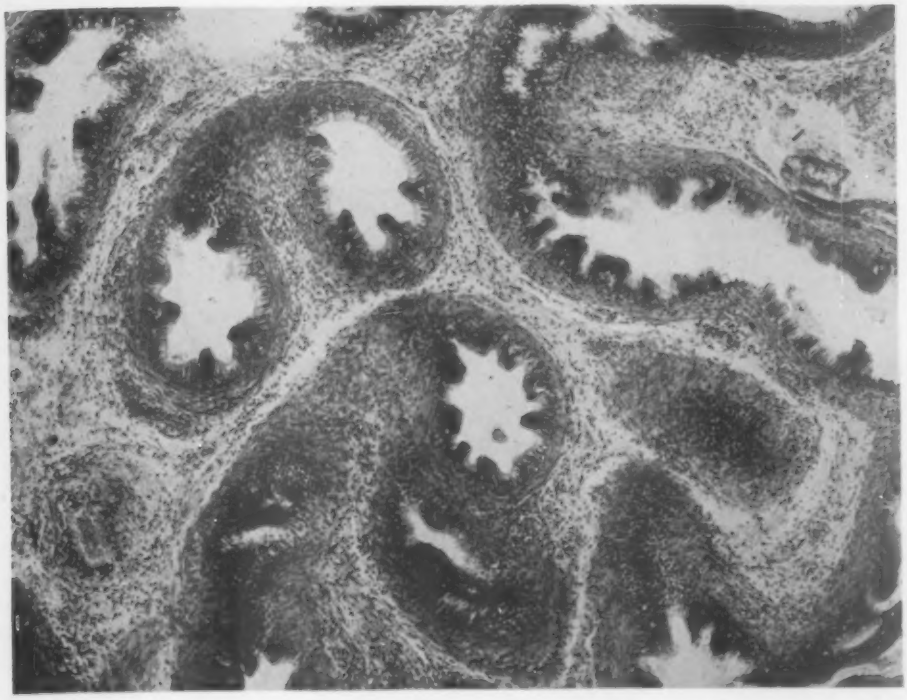

FIG. 11.—If the tubules are not destroyed, by peritubular sclerosis with contraction and by proliferation of the lining epithelium, numerous papillary projections into the lumina are formed. See text.

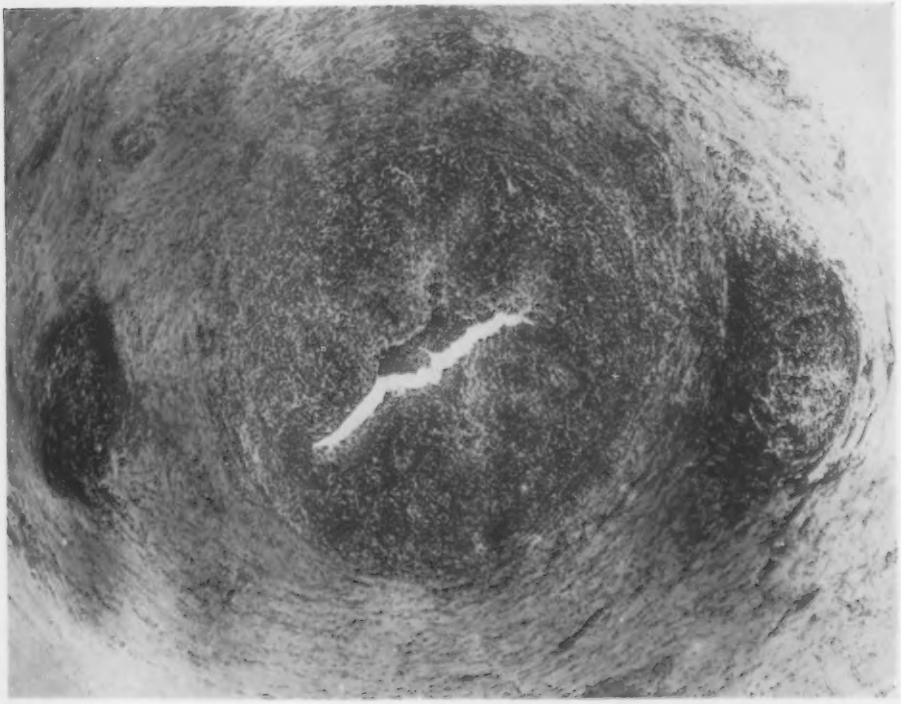

FIG. 12.—Acute exudative vas deferentitis with occlusion of the duct and marked infiltration of vasal lymphatics.

late acute become that of relatively early chronic epididymitis. As a rule, a type change in the leucocytic infiltration is observed, lymphocytes come to outnumber the polymorphonuclears. Too, there is a marked increase in the large mononuclear phagocytes, another characteristic of the repair process. Although the epididymis may be a mass of resolving areas of necrosis, vas-

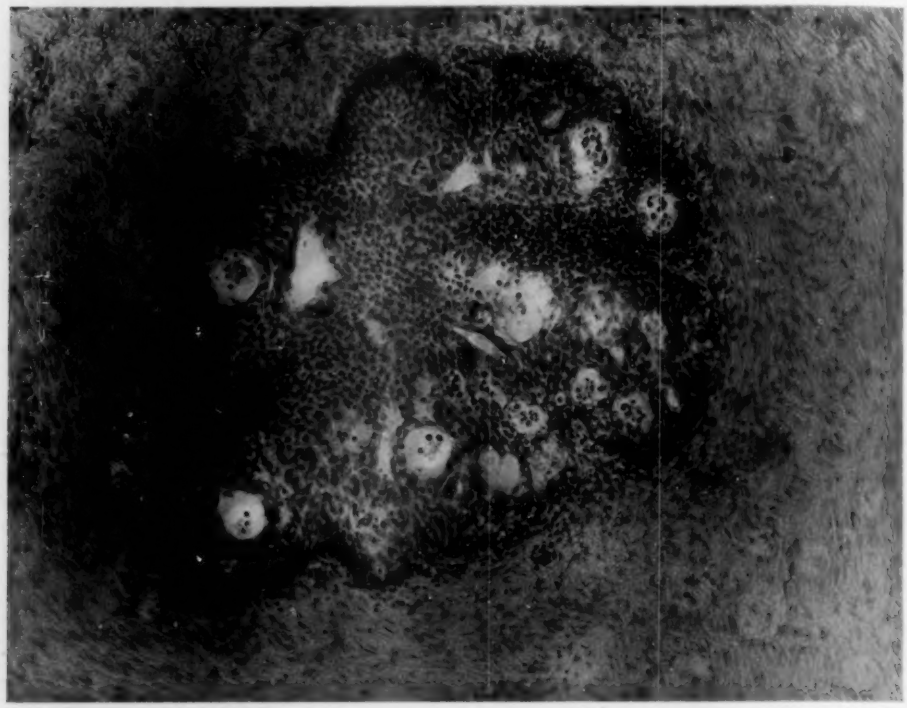

FIG. 13.--End result of condition shown in Fig. 12. Often the vas is completely blocked by scar—perhaps more often partially occluded as shown in this section.

cular and connective tissue repair is everywhere evident, but is most active about the periphery of these abscesses. As new scar is laid down, the massive œdema disappears and by this repair necrotic debris is replaced by connective tissue. Areas showing considerable fibrosis may by compression of the blood-vessels be relatively anemic. While vascular proliferation is universally evident with the formation of myriads of new capillary sprouts (Fig. 8) marked thickening of the walls of the older vessels by infiltration, scarring, or perisclerosis occurs. (Fig. 9.)

This sclerosis constitutes the proliferative or terminal phase of the inflammatory process. With the absorption of the exudate and necrotic tissue and its replacement by scar, the remains of many tubules disappear. (Fig. 10.) Other tubules become permanently occluded by post-inflammatory organization, while still others remaining patent undergo hyperplastic changes which are diagnostically characteristic of this stage of the disease. (Fig. 11.) The normal cylindrical epithelium having been lost by exudation, it is replaced by the squamous type. By irregular overgrowth it produces areas of heaped up

epithelium extending into the lumen of the tubules suggestive of papillomata. Contraction of the tubular walls by intra- and perimural infiltration and sclerosis greatly increases this intratubular intrusion. This squamous cell hyperplasia and sclerotic contraction of the walls may actually occlude the tubules. Bearing in mind this picture of generalized scarring, it is not difficult to understand the presence of residual nodular indurations so often clinically palpable twenty years after the acute attack. Most of these persist for life.

Some of our material was removed from patients suffering a recurrent attack and in these specimens all stages of inflammation may be observed. The acute exudative and suppurative phases are found superimposed on a background of tissue previously inflamed but now scarred and indurated. Sparcity of tubules—few if any are normal—and marked overgrowth of connective tissue with a corresponding decrease of vascularity in these areas is characteristic. The clinical recurrence of an epididymitis means the vas and some tubules are still patent and suggests probable fertility of the side involved, although it is conceivable that in these cases the epididymitis results from a lymph borne infection.

Moreover, the histological study of the inflamed epididymis causes one to emphasize not that sterility follows bilateral involvement in over 40 per cent. of the cases, but that any of these patients may be fertile following such an attack. Such studies further advance the argument in favor of a liberal attitude toward the early performance of epididymotomy; early drainage presumably will tend to lessen tubular destruction.

Changes in the testicle are those of collateral inflammation. If the attack is of recent onset, acute passive congestion with a variable degree of cloudy swelling may be observed. With suppurative extension from the epididymis, massive destruction of the testicular tubules with ultimate total gangrene ensues. This is not uncommonly seen in those patients whose surgical treatment has been delayed; perhaps the clinical indications for operation have passed unheeded or unrecognized. The testicle is lost by necrotic slough or orchidectomy.

The pathological process in the vas deferens is histologically the same as that of the epididymis (Fig. 12). The lesion is most severe in proximity to the globus minor where abscesses of the duct are occasionally encountered. Repair is a sclerotic process and not infrequently results in occlusion of the vas (Fig. 13) and may account in some instances for the failure of epididymovasostomy to cure sterility.

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GENESIS, MORPHOLOGY, AND SURGERY OF PROSTATIC MIDDLE LOBE HYPERTROPHY*

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The unique and uniformly successful development of the clinical surgery of prostatic hypertrophy during the past quarter of a century has now come to a stationary point. The lethal quotient has been brought almost to an irreducible minimum and at the same time a brilliant epoch of clinical advancement and clinical achievement has been recorded. It is another example, among many, where under the urge of necessity, by bold and intensive studies, clinical surgery has rapidly outdistanced the fundamental sciences in our knowledge of an organ, but it leaves a tremendous void which must be filled before further advance can be expected.

Taking stock today finds us without accurate knowledge on many fundamental facts in regard to the prostate. For instance, what is the normal physiological function of the prostate? Has it an internal secretion? What part does it play in micturition? What part does it play in our sexual life, etc., etc.? An equal lapse in our knowledge exists when one tries to correlate the various studies on the pathology of benign prostatic hypertrophy. We have not yet decided whether it be an hypertrophy or an hyperplasia. We do not know its etiology, are not in agreement as to where it starts, nor as to how growth proceeds. Residual urine accumulation is no more the simple problem of a dam in the stream, with its pool behind it, than is the wonderful rejuvenation following prostatectomy due alone to better sleep, kidney function, and normal micturition. There are deeper physiological and pathological problems here awaiting investigation. Hence it is that I wish to present to you tonight some studies on the genesis, morphology and surgery of the middle lobe of the prostate, a portion of the gland whose terminology is vague, whose growth is probably the most obstructive, whose diagnosis is difficult and whose surgery is most important, taking for granted that we all recognize today that in hypertrophy the prostate does, at times, form a midline lobular mass which we term clinically a middle lobe.

The point of origin of all prostatic hypertrophies has interested numerous investigators. However, throughout the literature there seems to run a constant tendency to attempt to make one theory of origin or of location to fit all cases of hypertrophy, rarely allowing for variation from one supposedly fixed standard location of origin of growth. For instance, Tandler and Zuckerkandl advanced the theory fifteen years ago that the first changes always occur in the tissue lying in the midline, otherwise called the posterior commissure and that hypertrophy is never absent at this point. Tandler,

* Read before the Philadelphia Academy of Surgery, January 16, 1928.

in the 1922 edition of his work with Zuckerkandl, spends the greater part of the text in correcting this previous statement and now attempts to prove that the hypertrophy arises superficially to this glandular tissue and presses this posterior commissural tissue backward. This is adopting the work of Motz and Perearneau that hypertrophy always originates in the superficial "mucosal glands" closely surrounding the urethral lumen, a point of view that seems to have received rather general acceptance, except in occasional instances. These are but two examples among many of the tendency of investigators to ascribe the origin of hypertrophy to one fixed group of gland acini, a tendency to dogmatize that I cannot but feel is the resultant offspring of studying too small a series of specimens. It has been my experience to find such a variety of types of hypertrophic growth that it has been hard to classify them into groups, and absolutely impossible to bring oneself to feel that the origin and location has been uniformly the same in all cases. In other words, it has been impossible to correlate my findings with the idea that hypertrophy invariably originates in or at any one fixed area, or in any one set group of prostatic gland acini. But on the contrary, I believe that hypertrophy may originate in any one lobe of the prostate, with the possible exception of the true posterior lobe. This means that the glandular tissue of the right and the left lateral lobes, the glands of the anatomical middle lobe more truly termed the posterior commissure, and the subcervical gland of Albarran, are the tissues sharing in hypertrophic proliferation, and that any one, or any combination of these may be the seat of the origin of the growth.

If one will accept these statements that hypertrophy may originate in any of these locations, it will immediately be appreciated that we should find a marked variety of contours or shapes in different specimens. We should find solitary lateral lobe hypertrophies, solitary commissural hypertrophies, solitary Albarran's subcervical gland hypertrophies, also we should find combinations of any two of these, or all of them together. It has been possible in studying my material to prove these statements, but I wish to confine my remarks to the hypertrophies occurring in the midline and obstructing the posterior vesical lip, either as solitary growths or in conjunction with lateral lobe enlargement.

I believe there are two absolutely different enlargements called by the same name of "middle lobe." Anatomically, there are two different glandular elements situated in the midline posteriorly; first, the posterior commissural glandular tissue, and secondly, the subcervical glandular tissue of Albarran. Either may undergo hypertrophy independently of the other, or independently of lateral lobe growth. Likewise, either may grow in conjunction with lateral lobe enlargement, or in conjunction with each other. As they have essential anatomical differences in their attachments, and encapsulations, they present a different gross pathological picture and differing surgical problems for their approach and for their successful removal.

The posterior commissural tissue is the anatomical middle lobe, a definite mass of glandular tissue, macroscopically visible, in normal adult development

contiguous with the lateral lobe glandular tissue, sharing with them the true prostatic capsule and not showing any independent separating capsule or fibres. This glandular commissural tissue is apparently almost always present, though there appear to be exceptions to the rule, and Lowsley reports such a case in his series of microscopic studies, and Albarran reports four specimens where it was absent in his series of one hundred and eleven specimens studied, and I feel it may be more frequently absent. Possibly in some cases it may be destroyed by inflammation or in others pushed back and compressed, as Tandler would explain it, by lateral lobe growth.

On the other hand, when the posterior commissural glandular tissue does hypertrophy, it first causes a thickening and elevation of the posterior vesical lip, and at this stage I have been prone to speak of such as glandular median bars. Macroscopically, at this stage, there may be no evidence of lateral lobe hypertrophy. On further hypertrophy, the commissural tissue raises upward the apex of the trigone, the vesical lip and the first portion of the floor of the urethra. The sphincter gradually drifts backward and behind the hypertrophying mass, and the hypertrophy is constantly confined by the prostatic capsule and always under the trigonal muscle. It ultimately grows to form a thumb-like projection into the bladder cavity, broad, flat, sessile, with widely separated clefts in the posterior-lateral angles. In long-standing cases, and those showing massive enlargement, some hypertrophy of the lateral lobes becomes evident, or in my most marked cases, it shares an equal part with lateral lobe growth. It is a stoggy, dullard of a country bumpkin variety as compared to its companion growth, the dainty, artistic, symmetrical, poised and graceful subcervical gland hypertrophy of Albarran.

These latter (subcervical hypertrophies) start as a small rounded nodule just infra-sphincteric and quickly become spheroidal in shape: by the time they are large enough to push up through the sphincter, pedunculation has started and from then on this characteristic is never lost and never absent. Its only covering is the mucous membrane and its only attachment its own ducts forming a definite pedicle. There need be no lateral lobe enlargement, and even if present, there being no common capsule, there is no tissue attachment to the same or glandular continuity. It stands alone as a spheroidal, pedunculated lobular mass, and may grow to an equal size of any prostatic lobe.

The query may be put as to which of these do we mean when the term "middle lobe" is used.

The differentiation between these two entities, posterior commissural hypertrophy and subcervical hypertrophy, is not an academic question only, for it is an important matter when it comes to the proper and complete removal at operation and the recognition of the type present pre-operatively should change the technic of enucleation which, if made to suit the case at hand, insures radical and clean removal, minimizes damage to contiguous structure, and lessens the danger of post-operative bleeding.

The differential diagnosis can be made by combined rectal and by cystoscopic study.

The posterior commissural hypertrophy, on rectal examination, presents a flattening out of the mid-prostatic groove with a broad flaring out of the upper lateral lobe limits, and a greater tissue mass in the inter-vesicular, subtrigonal region. Cystoscopically, one appreciates a generalized thickening of the posterior vesical lip, a partial, or complete, obscuring of the trigone, and on retracting the instrument one seems to travel a long distance before actually entering the posterior urethra. Clefting, if present, is found far out in the lateral sulci, and if one but follows it, it leads into the posterior urethra, without meeting the one from the opposite side, while with an instrument in the urethra and a finger in the rectum, the thickened mass is readily appreciated as the instrument easily stays in the midline and rides over the hypertrophic lobe.

Subcervical hypertrophy, on the other hand, because of its one outspoken characteristic, that of pendunculation, presents easily recognized variations from this picture. It is an intravesical growth and cannot be felt by rectum under any circumstances and when it alone is enlarged the rectal examination may be most unsatisfactory and even misleading. On passing the cystoscope, the instrument invariably enters to one side or the other of the lobe which on observation may be mistaken for the rotundity of a lateral lobe enlargement, and sometimes not until one looks directly upward do you catch the change of contour which if followed leads you (and the cystoscope) into the opposite cleft with a complete reversal of the picture. In even moderate sized hypertrophies of this variety it is almost impossible to keep the instrument on the summit of the lobe and follow it into the urethra by drawing the cystoscope outward. But if you follow either lateral cleft into the urethra it will be found to practically meet the one from the opposite side because of the narrow pedunculation. Rectal examination, while the instrument is in place, gives no increased thickening, as the instrument regularly lies lateral to the lobe. So one may say that the diagnosis of subcervical hypertrophy is made by cystoscopic examination alone.

Prostatic surgery of today has reached the stage where instead of analyzing the mortality we study the post-operative morbidity of our patients. An ideal prostatectomy, whether done suprapubically, or perineally, should remove all hypertrophic tissue, restore normal function and last permanently. In order that this may be true, the actual enucleation should be performed by passing through the characteristic line of cleavage and never, if possible, to remove a lobe except in toto, and where hypertrophy in one lobe is continuous with other adenomatous proliferation, the enucleation should continue until easy separation of the entire mass occurs.

The surgical deductions to be arrived at from the differentiation between posterior commissural hypertrophy and subcervical hypertrophy are very valuable for the clean, easy and truly surgical removal in each individual case, and a pre-operative appreciation of the work ahead expedites the procedure, facilitates a clean enucleation, minimizes hemorrhage and insures permanency of cure.

In *posterior commissural hypertrophy*, when also associated with lateral lobe enlargement, is approached suprapubically, the enucleation, starting intra-urethrally, sweeps about one lateral lobe and should pass across the urethra and the apex of the trigone and the finger goes, without difficulty of any degree, directly around the opposite lateral lobe and the prostatic mass is removed in one piece. If the commissural hypertrophy is present without lateral lobe enlargement, the break through the mucous membrane must be made in a cleft at either of the lower lateral angles of the internal vesical orifice and commissural tissue alone enucleated.

If the approach be from the perineal side, the greatest care must be exercised that a lateral lobe be not removed from either capsule and the commissural tissue (undoubtedly the most obstructive portion) missed entirely. In such a case the Hinman modification of Young's prostatic incision is ideal, and one should again endeavor to keep the adenoma intact and hugging the capsule obtain a single mass enucleation.

In *subcervical lobe hypertrophy*, on the other hand, when approached suprapubically, the characteristic pedunculation and the knowledge that its capsule consists only of mucous membrane, permits the surgeon to pinch it off the first thing: you cannot, nor should not, save its mucous membrane, all of which is redundant and I am in the habit of placing a clamp on the lobe and simply twisting its pedicle to the point of rupture. Occasionally I have ligated the pedicle first but doubt the utility. If subcervical hypertrophy is accompanied by lateral lobe enlargement as well, the suprapubic enucleation entails first the removal of the subcervical lobe, next the enucleation of one lateral lobe, and thirdly, the removal of the other lateral lobe: that is, one enucleates and removes three separate masses.

In perineal prostatectomy a subcervical hypertrophy presents a peculiar complication all its own. As it does not lie within the prostatic capsule and as that structure is entered on its posterior surface, a complete lateral lobe and commissural growth may be removed and a subcervical lobe hypertrophy missed entirely. Neither can such a lobe be made to present itself into a lateral lobe cavity unless the urethral lumen has been entered and then only the lobe may be dislocated so as to enter first the posterior urethra, then a lateral lobe cavity, and from thence to the perineal exposure. If clean enucleation has been performed on the lateral lobes, the preferable and only way to remove such a subcervical lobe in perineal prostatectomy is to withdraw the prostatic tractor entirely and with a spoon retractor, or lobe forceps, entered through the urethrotomy incision, grasp the lobe and attempt to draw it down through the posterior urethra to a point where its attachment can be ruptured and the mass removed. This complication is the most serious objection to a perineal prostatectomy in such cases, for though its removal can be usually accomplished, the possibility of complete oversight, the occasional difficulty of removal, the uncertainty of enucleating such a lobe without leaving behind redundant tags of mucous membrane, and when unusually

large, the complete inability to reduce such a lobe to the perineal field—it being an intravesical tumor—all make me feel that such enlargements belong essentially to the suprapubic operation.

Such is the gross pathology of so-called "middle lobes" and their surgical bearing. Factors are present that I feel sure play important rôles in prompt convalescence and complete cures. The terminology has allowed of misunderstandings both in the literature, and in clinical teaching, and in society discussion, and I speak for your approval, that in the future, we eschew the use of the term "middle lobe" and purify our terminology on such occasions, by speaking of them as a lobe from either commissural hypertrophy, or from subcervical hypertrophy.

CLOSURE OF THE PROSTATIC BED IN SUPRA-PUBIC PROSTATECTOMY *

By John B. Deaver, M.D.
of Philadelphia, Pa.

In the last several cases of one-stage supra-pubic prostatectomy I have closed the prostatic bed with satisfactory results and shortened convalescence.

The advantage of closing the prostatic bed is that neither the prostatic bag nor gauze packing is required, and that not having to use either, the chance of bleeding, especially secondary hemorrhage and infection of the bed is minimized. In the badly infected bladder however, where the smear shows the presence of the colon bacillus or other form of pus-bearing microörganism, closing of the prostatic bed is not advisable. Closure of the bed is not so easily made in the two-stage operation, on account of the more limited space and the lessened flexibility of the tissues following the primary operation. I now rarely do a two-stage operation, and in the past I have done it only in what were considered "bad risks." At the present time there are fewer bad risk cases than formerly because of our prolonged preoperative treatment, directed to controlling conditions by catheter drainage and more especially careful consideration of the functional tests. The first-stage operation is now avoided by the use of an inlying catheter which as a rule is practically harmless. In passing I can cite the instance of one patient who wore an inlying catheter for fourteen years during which time not a drop of urine could be voided naturally. In this patient removal of the prostate, on account of other conditions, was out of the question.

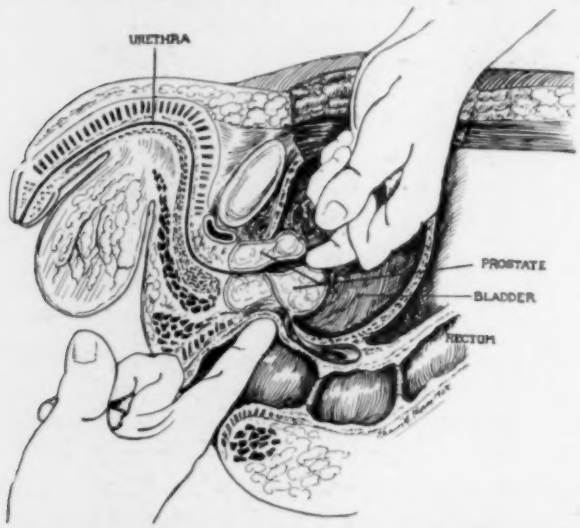

Fig. 1.—Sagittal section showing enucleation of prostate by middle finger of left hand aided by finger in rectum pushing the gland upward.

Closure of the prostatic bed while not an impossible procedure is not

* Read before a joint meeting of the New York Academy of Surgery and Philadelphia Academy of Surgery, Philadelphia, February 8, 1928.

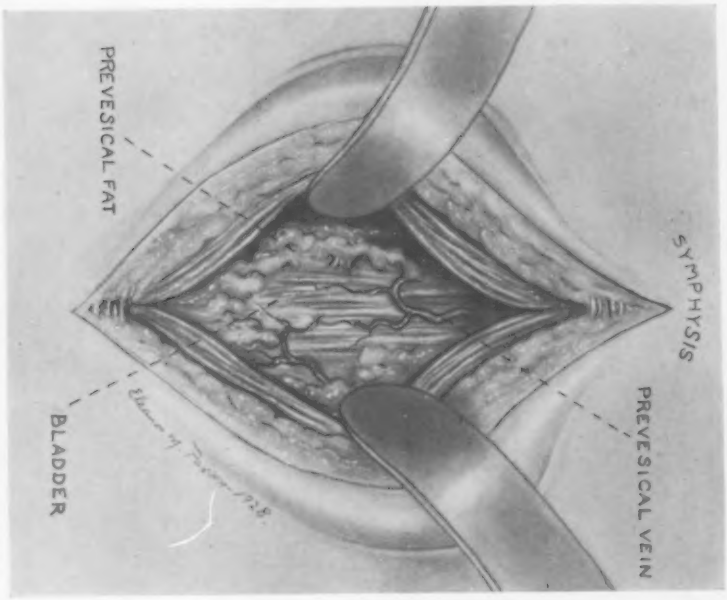

FIG. 2.—Step I. Exposure of bladder, showing prevesical fat.

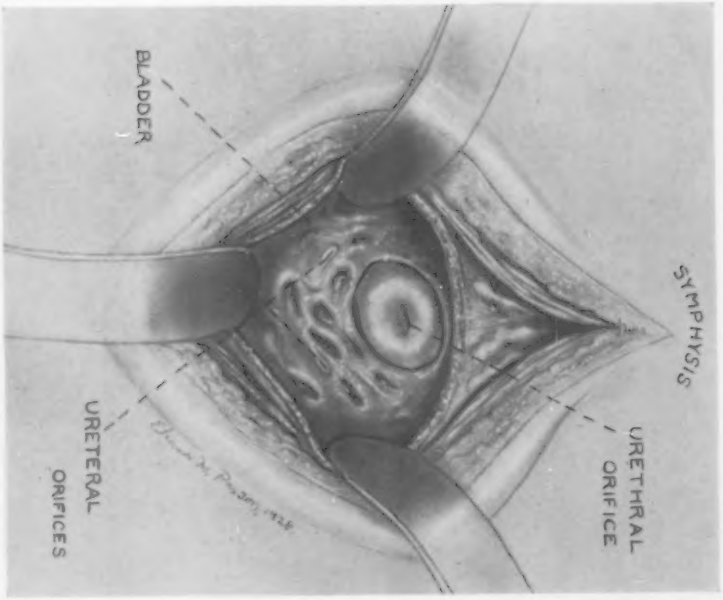

FIG. 3.—Step II. Bladder opened showing enlarged prostate protruding into bladder.

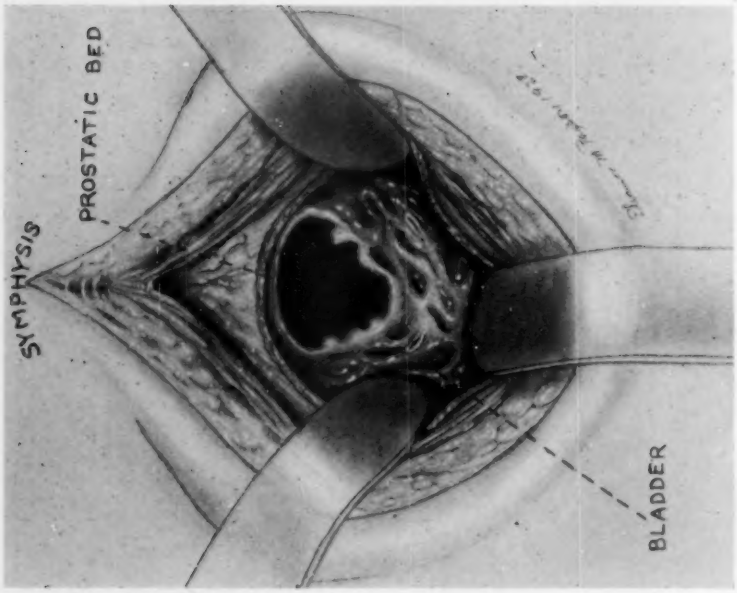

FIG. 5.—Step IV. Showing ragged hole after enucleation of prostate.

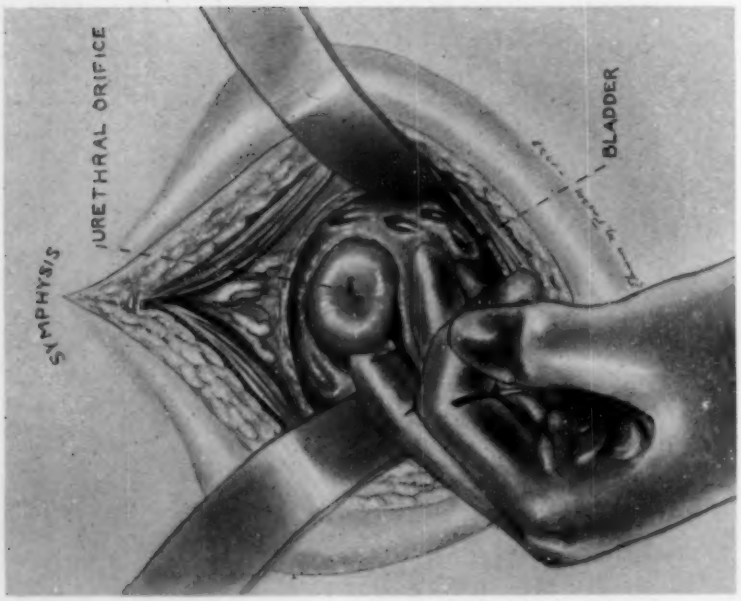

FIG. 4.—Step III. Enucleating an enlarged prostate with middle finger of left hand.

always an easy one. By the following technic it can be satisfactorily done. With the patient under either nitrous oxide and oxygen or, preferably, spinal anæsthesia, and in the Trendelenburg position, the incision is made and the bladder wound retracted laterally, and fore and aft, using the proper size Deaver retractors, after introducing a small, moist gauze pad into the fundus of the bladder over which the upper retractor is placed so that when traction is made, the floor of the bladder will be level, giving a good view of the wall of the bladder, the prostate, the orifices of the ureters, and after the prostate is removed, of the prostatic bed. The margins of the opening of the bed are grasped and retracted by Allis forceps. The finger of an assistant in the rectum carries the floor of the prostatic bed upward into the opening of the bed where with the aid of a Cameron light bleeding points are seen and ligated and with a curved needle of proper size and shape the walls of the bed are approximated laterally up to the torn end of the urethra. A soft rubber catheter is then carried into the bladder through the urethra and left in, a large rubber tube is placed in the bladder and the bladder wound closed up to this tube. I always place a small piece of rubber dam in the prevesical space, and remove it on the second day. The supra-pubic tube is taken out as soon as the urine is clear, and the catheter is left in the bladder until the supra-pubic wound has closed, an average period of ten to fifteen days. The convalescence under this method is more comfortable and shorter than by our former methods. The ingenious appliances for carrying out supra-pubic drainage to avoid soiling of the patient's linen are not used in our clinic; in fact I have never used them, having been satisfied with drainage through a long rubber tube attached to the supra-pubic tube and carried beneath the bed clothes to the side of the bed and into a urinal tied to the frame of the bed, all of which is concealed by the depending bed coverings.

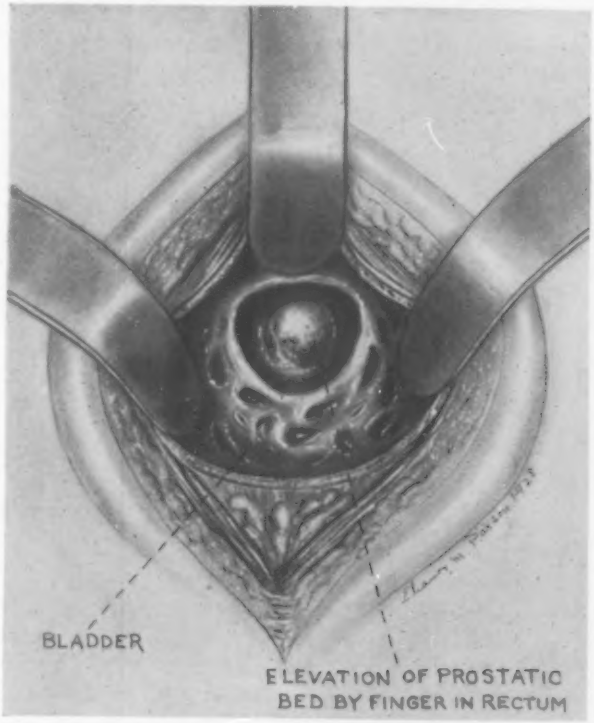

FIG. 6.—Step V. Prostatic bed elevated by finger in rectum—edges of opening trimmed off.

The large prostatic bed with little or no attempt to contract, that oozes

freely and does not respond to irrigation with hot water, I have been able to close satisfactorily. In the prostatic bed that contracts promptly and oozes little, there is no particular advantage in suturing except possibly to shorten convalescence.

This is not a new procedure as it has been satisfactorily done by W. E. Lower by whom, I believe, it was first carried out. The technic I have described however differs from Lower's in that, as I believe, I make a better exposure. I may be wrong in this, as I have not seen Lower make the closure. My manner of closing the bed also differs from his in that I do not close it around a catheter. In my earlier experience in closing the prostatic bed I did not pass a catheter until the supra-pubic tube was removed. One of the last patients in whom I closed the prostatic bed was eighty-six years old and left the Clinic fifteen days after the operation voiding spontaneously, and in fine condition.

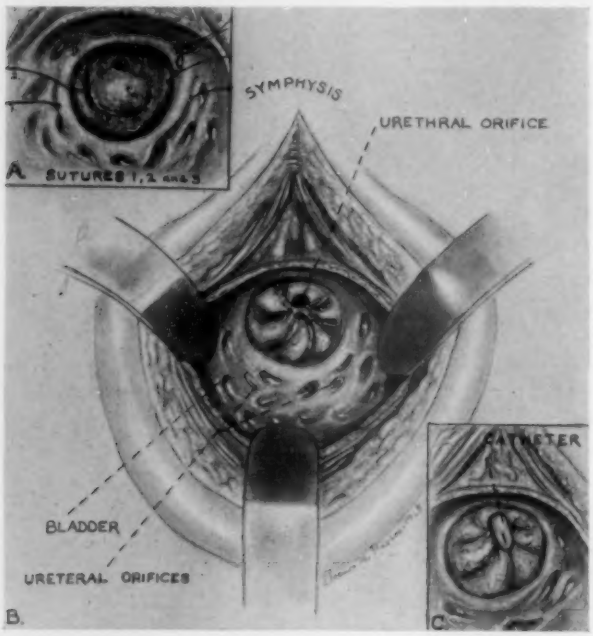

FIG. 7.—Step VI. A. Closure of prostatic bed by three interrupted sutures. B. Bed closed, showing urethral orifice. C. Catheter in urethral orifice.

The sutures of chromic catgut number 1 are introduced under the eye and readily so with the floor of the bed and the anterior wall of the rectum carried upward by the finger of the assistant in the rectum. I have had no trouble in avoiding injuring the wall of the rectum, the assistant's finger being a guide, and the fascial and muscular covering of the bowel being enough in evidence to avoid accidents if gentle manipulation of the needle is observed.

While it is too early to speak of subsequent contraction and stricture, I think this is less likely to occur than after the introduction of a bag or gauze. I have seen stricture following supra-pubic removal of the prostate, one of the causes of a supra-pubic sinus, and necessitating the passage of sounds. In the procedure I have described the catheter is in contact with mucous membrane only, therefore there is less likelihood of subsequent stricture. Up to the present, I have not closed the bladder wound entirely. Please don't go away with the idea that I never make a two-stage operation, for occasionally I do. For example, I make use of the two-stage operation where an inlying catheter is not well tolerated, where there is an aggravated

cystitis, and where upon opening the bladder the mucous membrane is chocolate-colored, and bleeds to the slightest touch—in other words, toxic—and where there is a large diverticulum with pus retention. Any or all of these conditions can only be properly handled by prolonged supra-pubic drainage.

The presence of stone, papilloma, or diverticulum calls for removal and prolonged drainage following the first-stage operation. I hope I have made myself clear. The removal of a large diverticulum containing a considerable amount of pus usually can be done at the time of the first-stage operation, yet this is a question for judgment.

The one-stage operation is an operation in the open throughout, and thus far has given me satisfactory results to say the least, and like other operative procedures the more you do of them, the better and the easier they are. A perfect intra-spinal anæsthesia makes the supra-pubic removal of the prostate a joy shared by both patient and surgeon.

XANTHOMA OF THE NECK

By Charles E. Humiston, M.D.
and
Eugene C. Piette, M.D.
of Oak Park, Ill.
from the West Suburban Hospital

"Xanthoma" means a yellow tumor. The golden yellow color of the tumor tissue, resembling that of the corpus luteum or of the cortex of the adrenal gland, is due to intracellular accumulation of certain peculiar fatty substances such as double refractile cholesterol ester, protagon, and neutral fats. After dissolving this ester in the process of preparation of ordinary microscopic sections, the tumor cells assume characteristic "foam" appearance, typical of xanthoma.

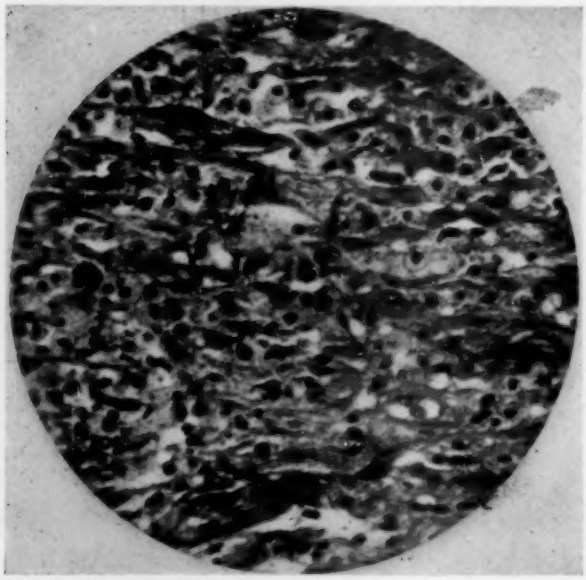

Fig. 1.—Œdematous portion of the tumor, showing numerous small—vacuolated "xanthoma cells" in the meshes of syncytium—forming elongated spindle-shaped cells. A little off and below the centre a plasma cell is seen, marked by an asterisk.

There is hardly another problem in oncology, the study of tumors, with so much confusion of ideas, terms and interpretations. In fact, the name "xanthoma" is omitted in some of the modern textbooks because of this confusion. Yet the recent investigations have cleared up many questions concerning the nature of these rare tumor formations, clinical studies have shown their benign character, and experimental work has cleared up problems of pathogenesis. Therefore xanthoma ought to be a well known nosological unity to every modern physician.

As we have pointed out in cholesteatomas,[1] it is necessary to differentiate in xanthomas between inflammatory and neoplastic growths. Inflammatory tissue formations, containing foam cells, are well known as xanthelasma on the eyelids of persons of advanced age or as subcutaneous lumps in diabetic patients. Lesions of this kind were repeatedly produced experimentally, particularly by Anichkov,[2] from Petrograd, and his school (see Kusnetzowsky[3]). After inducing hypercholesterolemia in rabbits any chronic irri-

tation will lead to the formation of tissue nodules, which are yellow on the cut surface and contain numerous foam cells loaded with "liquid crystals" of cholesterol esters.

Subcutaneous and intracutaneous nodules, having gross and microscopical appearance of xanthoma are well known to dermatologists. These tumor-like formations are mostly small, even if they produce some elevation of the skin—xanthoma planum or tuberosum. The true neoplasmas, "xanthome en tumeurs" of the French writers, are not of common occurrence and are mostly associated with tendon sheaths or joints. Thus Tourneau [4] collected in 1913, 54 cases, Reid [5] in 1914 described 4 cases, Stewart and Flint [6] added in 1915, 17 cases, Broders [7] added the same number of cases, etc.[8]

Xanthomata not associated with tendons or joints are very rare. In recent literature we were able to find only three cases of Smith,[9] one small tumor being located on the tongue, (apparently rhabdomyoma), one on the labia minora and one in the parotid gland, whereas Lutz [10] described a similar tumor in the mesentery, and Beitzke [11] in the meninges. Therefore the publication of an additional case seems to be quite appropriate.

Mrs. Anna G., aged fifty-two, born in Germany, was admitted to the West Suburban Hospital, in July, 1925, with the following history. There had been a swelling in the left side of the neck for several years. Two years before admission the "lump" had been incised and a drain inserted, but no pus evacuated. Recently the "lump" showed increase in size. Movement of the head was being interfered with and there was a change in the voice—a "hoarseness." At no time had the growth been painful—the only discomfort being mechanical interference with the movements of the head. The patient thought she looked like a "one-sided case of the mumps."

Examination shows a tumor occupying the left upper side of the neck. It is deeply situated and displaces the parotid outward. There is marked but not expansile pulsation. The tumor is beneath the parotid but evidently not connected with it. The tumor is very conspicuous even at a considerable distance, and suggests a parotid tumor. The lower limit is rather below the usual site of the bifurcation of the common carotid.

Operation was done July 7, 1925, at the West Suburban Hospital, Oak Park, Ill. A curvilinear incision was made from above downward over the greatest convexity of the tumor. The sterno-mastoid was found to be very wide and greatly thinned. Incision through it permitted most of its muscular mass to be displaced backward. The tumor was found to hug the cervical vertebræ and to have crowded the carotid vessels forward (mediad). The internal jugular was displaced from its usual association with the internal and common carotids to the extent of more than 2 centimetres. During the dissection the internal jugular vein was torn and had to be resected. The tumor was distinctly encapsuled and not greatly adherent to surrounding structures; above it was in contact with the base of the skull. Its removal was difficult mostly on account of its size. No large vessels entered the substance of the tumor. On account of the intimate association of the tumor with the carotid vessels a ligature was placed about the common carotid, but it did not become necessary to tie this ligature. The vagus remained in close anatomical relationship with the carotid and appeared to escape injury. The gross specimen on removal measured 9 x 5 x 5 centimetres. The clinical diagnosis at operation was carotid tumor, because of its intimate anatomical associations.

The convalescence was without complication. The scar is now inconspicuous. The voice at this writing, January, 1928, is unimpaired. There is no sign of recurrence.

Blood cholesterol at the time of operation was 310 mgm. Two years later, 5-2-27, it was still high—245 mgm. (normal values being 150–170 mgm. per 100 c.c. of blood).

The tumor removed is ovoid in shape and has the size of a goose egg, measuring 8 x 4 x 4. 5 cm., possesses only a thin capsule, which is rather firmly attached to the surrounding connective tissue structures. It is yellowish on the outside. Its consistency is soft, fluctuating. Upon cutting into the tumor tissue an irregular cystic cavity is found, filled up with bloody serous fluid. The cavity is rather large, the shell being from 0.5 up to 2 cm. in thickness. The inner surface of the cyst is bright yellow, rough, and irregular, with many crypts and excavations, showing all the typical earmarks of the cystic degeneration of a primary solid tumor. The tumor tissue of the shell is somewhat lamellated grossly, its cut surface showing white streaks and large, bright, orange yellow spots. A few areas of hemorrhage are present, particularly near the cavity. The predominating yellow shade of the tumor, its soft consistency and cystic degeneration of the central portions lead to the diagnosis of xanthoma on gross examination.

Upon examination of the unstained frozen sections numerous intracellular droplets and needles of highly refractile material are found which dissolve after the addition of absolute alcohol, ether or chloroform. The examination of the unstained frozen sections with polarisation microscope, done by Dr. R. Jaffe, reveals double refractile properties of these inclusions, as manifested by the appearance of crossed diameters in each individual droplet. They react positively to the Sudan III stain.

Examination of paraffin sections (fixation in Bouin's fluid) stained with hematoxylin-eosin, Van Gieson and Alzheimer neuroglia methods (the latter done obligingly by Dr. G. B. Hassin), reveals the following picture. The tumor tissue is rather cellular, many nuclei being present. The tumor is built up chiefly of a syncytium of large spindle cells, which are not separated from each other, but form a continuous single mass of cytoplasm, infiltrated with many vacuoles and containing numerous spindle-shaped vesicular nuclei with fine and uniformly distributed chromatin granules. The spindle-shaped nuclei decidedly predominate in the majority of fields; in some places the cytoplasm is more abundant, in others reduced. In addition to these spindle-shaped nuclei, numerous round nuclei with the same distribution of chromatin are present, their cytoplasm being more isolated from the syncytial mass. The round cells are 15–25 microns in size, whereas the spindle cells have the size of a fibroblast. In a few rather isolated spots the round cells assume the typical appearance of foam cells, because of accumulation of fatty products in their cytoplasm, but the general character of the nuclei still remains the same.

There are a few peculiar large cells in the tumor, apparently derived from spindle cells by increase in size. They are from five to ten times larger than the spindle cell of the tumor. They possess large vesicular nuclei with a few small clumps of chromatin and 1–2–3 large acidophilic nucleoli. They resemble somewhat ganglionar nervous cells; however, no Nissle tigroid substance is found in their cytoplasm.

In the regions of cystic degeneration some of the round cells undergo peculiar changes. They increase in size, separate themselves from the underlying structure, assume epithelial-like appearance, form some sort of inner lining of the cyst cavities and not infrequently transform into multinuclear giant cells.

The essential cellular constituents of the tumor are therefore: (1) syncytium—forming relatively large spindle cells, some of which apparently give rise to the formation of large "ganglion-like" cells with eosinophilic nucleoli, and (2) round cells, transformed in some places into "foam" cells, or rarely, into epithelial-like or multinuclear giant cells, the latter processes being confined to the area of cystic degeneration.

The interstitial connective tissue, stroma of the tumor, is by no means an abundant one. Only here and there an individual collagen fibre is found. A few layers of collagen fibres form a thin capsule on the periphery of the tumor. The blood-vessels are not numerous and show marked hyalin changes, the wall being thick and structureless, the endothelium rather swollen. The retrogressive and even inflammatory changes therefore are quite prominent; also foci of plasmocellular and lymphocytic infiltration, foci of intra-

cellular hemosiderin deposits are found. A quite striking feature is rather diffuse distribution of isolated plasma cells, which may have even some diagnostic significance. The numerous small cyst cavities, due to colliquation necrosis, are filled up with coagulated granular or amorphous material and usually show also some sort of epithelial-like lining, the origin of which was already discussed. The lymph vessels or spaces are not numerous and apparently do not play such an important rôle, in our case, as is usually assigned to them in cystic degeneration of other solid tumors, as for instance, in leiomyoma.

On the sections stained with picrofucsin the cytoplasm of the syncytium stains definitely yellow, contrasting with the pink collagen fibres of the stroma. On sections stained by the Alzheimer method the syncytium does not give typical glial reaction, remaining light blue, but the contrast with the deep blue collagen fibres remains well pronounced.

The association of xanthomatous growths with hypercholesterolemia in experimental conditions, as well as in many cases of clinically observed patients—found also in our case—is of the utmost importance. One is justified in assuming that the high concentration of fatty substances in the blood may even play the rôle of causative factor, just like formation of "tophi" in gout. In other words, if in cases of gout the excessive amount of uric acid is deposited in certain tissues, in "xanthomatous diathesis" the excessive amount of fatty substances may be deposited in loose connective tissue, which normally stores the excess of fat. Therefore it is advisable to try to reduce hypercholesterolemia by some dietetic measures before using more radical methods of treatment. Fat-free diet is indicated, brain and eggs are particularly undesirable.

Xanthomata are essenially benign (Bloodgood [12]). Resembling granulation tissue, even when they form tumor masses, they are not definitely isolated from the surrounding structures, possess no firm capsule and simulate therefore a so-called infiltrative type of growth, a picture of "histological malignancy." That is the reason why they are usually called even now "xanthosarcoma." The analysis of the cases described fails however, as a rule, to reveal any definite and unquestionable signs of clinical malignancy. The addition of the word "sarcoma" is therefore not justified from the clinical standpoint, nor from the standpoint of the patient, which ought not to be neglected. Only in very few instances, as for instance in the case of Dietrich,[13] the malignant tendency of xanthomatous growth seems to be more evident. The only way to get rid of the term "histological malignancy" is by the painstaking accumulation of data in the subsequent clinical course such as is now being done by the leading clinics of this country.

But not all yellow tumors are benign. Many hypernephromata are malignant enough in spite of the presence of yellow areas on the cut surface. On the other hand, high grade lipemia may probably be responsible for the yellow discoloration of many different tumors, through intracellular deposits of the above mentioned lipoid substances. In recent literature Gauhl [14] mentions several cases of "carcinoma xanthomatodes" (Dubs in the fundus of the uterus, Kinoshita in the prostate, Petri in the stomach), also a case of "thymoma xanthomatodes" by Kneringer and Preisel. Many other cases of different tumors, containing abundant intracellular deposits of double refrac-

tile cholesterol needles and droplets have been described. Not uncommonly foam cells are found in benign tumors such as giant cell tumors, epulis, mammary fibroadenomata, etc., and even in inflammatory conditions, particularly in different forms of mastitis (Kadji, see [14]). Histological examination determines the nature of the process.

SUMMARY

1. The clinico-pathological entity of xanthoma is important.

2. Xanthoma is essentially a benign tumor, in spite of its "histologically malignant" structure.

3. The cases of xanthomatous formations (skin, tendon sheaths) associated with hypercholesterolemia ought to be given trial with suitable diet before undertaking more radical methods.

4. True tumor formations of xanthoma type not associated with tendon sheaths of joints are extremely rare. A case of xanthoma of the neck is reported.

5. From microscopic standpoint, the most essential cellular elements of xanthoma are: (a) spindle cells, (b) round cells, (c) foam cells (xanthoma cells), (d) giant cells, (e) isolated and diffusely distributed plasma cells.

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TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY AND THE NEW YORK SURGICAL SOCIETY

Conjoint Meeting Held February 8, 1928

Dr. Astley P. C. Ashhurst, in the Chair

Dr. Calvin M. Smyth, Recorder

POST TRAUMATIC ANKYLOSIS OF SCAPULA TO RIBS

Dr. J. Torrance Rugh presented a man aged forty-two years, who was first seen April 6, 1925, because of limited movement in the right shoulder and some pain on attempted work. February 10, 1925, while working, he fell, striking heavily on his right shoulder and back. The arm was said to have been dislocated and promptly reduced by a physician and the arm bandaged for a while. An X-ray was taken which showed fracture of the sixth and seventh ribs under the lower portion of the scapula but under adhesive strapping these promptly healed. When the bandages were removed and mobilization of the arm and shoulder was begun, the scapula was found to be fixed though scapulo-humeral movement was fairly free. When the reporter first saw him, an X-ray made nearly six weeks after the accident, showed a dense area of bone deposit under the scapula and over the site of the rib fractures. This area measured about 4 cm. vertically and horizontally and was of equal density throughout. He also presented several deep scars in the skin on the right side of his spine between the scapula and the vertebral spines which the patient said came from abscesses in that part following typhoid fever at the age of nineteen years. Careful inquiry revealed that there had been no limitation of shoulder and scapular motions and that he had played ball for years, pitching part of this time. One would naturally be suspicious that the abscesses rather than the injury might have caused the fusion but the very clear and positive history of free use for the intervening years seems conclusive. Attempts at mobilization of the scapula were made by masseurs but failed. May 15, 1925, a curved incision with the base external was made about the scapula, the skin reflected back about two inches and a flap of fat then lifted with the base toward the spine and ventral to the posterior scapular border. The fascia and the rhomboid and latissimus muscles were then loosed from the scapula, and directly beneath the scapula was found a plate of bone holding it to the ribs. With a broad osteotome, the scapula was first loosed from the bony mass and lifted upward and then the plate of bone was cut loose from the ribs. It was about four cm. in both directions and one cm. in thickness. After smoothing both denuded areas, a flap of fat was slipped beneath the scapula and held in place by several sutures. The latissimus and part of the rhomboid were then sutured in place and the skin closed. Recovery was uneventful and in two weeks mobilization and massage were begun. Improvement has been gradual and steady until now the arm has even more free action than the left one.

The interposition of the subscapularis, the serratus magnus and coarse areolar tissue furnishes most effective protection against fusion between the scapula and the ribs, but the only explanation in this case is that the rib fractures must have penetrated the muscle structures and injured the under surface of the scapula as well.

Dr. Frederick Bancroft, of New York, said that the formation of bone may be divided into repair of bone following injury and infection, experimental extra-skeletal bone, and pathological bone. Experimentally bone has been produced in animals by ligating the renal vessels and placing omentum over the kidney. In one or two months sections of the kidney show areas of true bone formation and areas of calcification occurring in the kidney parenchyma. This bone is true lamellar structure with bone cells and Haversian canals. In rabbits it may be produced by scraping the adventitia of the aorta and painting it with either silver nitrate or copper sulphate. Doctor Neuhof, working in the surgical research laboratories of the College of Physicians and Surgeons of Columbia University, has shown that in placing fascia lata transplants to cover defects in the bladder, bone is almost universally formed in these transplants. This tissue, both microscopically and chemically, resembles skeletal bone.

Bone is born pathologically in almost every region in the body. It occurs in the ovaries, in the lymph-nodes, in the adventitia of arteries, and in thyroid tumors. It frequently occurs in old hæmatomata. If then we are to produce any theory for bone formation, it must be broad enough to cover repair of bone following injury and infection, experimental and pathological extra-skeletal bone. There are three main theories for bone repair: 1. Periosteal and endosteal formation of bone. 2. Osteoblastic formation of bone. 3. Deposition calcium salts on the connective tissue stroma. The periosteal theory cannot account for the extra-skeletal bone formation. It is true that periosteum is an ideal site for bone formation. It has an outer fibrous layer and an inner layer of areolar tissue with finely divided blood-vessels. In the speaker's study of microscopic sections of bone repair he found that bone is laid down in areolar tissue in the extravascular areas. One will see a small blood-vessel surrounding which is an area of areolar tissue, and at the perivascular area is new bone. The osteoblastic theory assumes that osteoblasts are set free from the bone lacunæ, that they multiply and secrete new bone. It is difficult to account for the localization of these osteoblasts in fascia lata transplants of the bladder, such as seen in Neuhof's work. If fibroblasts may turn into osteoblasts by a process of metaplasia, all types of bone formation may be accounted for. The third theory assumes that through the change of the hydrogen-ion concentration calcium salts are deposited on the stroma or connective tissue, but the cell, the fibroblast, is only a passive agent in the production of new bone. The fibroblast then becomes a bone cell through functional adaptation. This theory, Doctor Bancroft believes, is the most convincing—and the simplest. It means that if the proper environment is created, bone formation will inevitably follow.

In Doctor Rugh's case, the etiological factors were trauma—resulting in the fracture of ribs—and extensive hemorrhage in the surrounding muscles, diminished blood supply due to the Velpeau bandage, which produced diminished expansibility of these tissues, as on one side there were ribs and on the other side the scapula. These factors are ideal for the formation of bone.

The advance in our knowledge of bone formation is going to come through bio-chemical studies rather than through the microscope. In the microscopic study of bone repair there is no clear differentiation of the cellular elements. One sees definitely connective tissue and cartilage cells, bone cells and connective tissue cells, but in the intermediary areas it is difficult to tell whether a cell is a connective tissue cell or a bone cell, a connective tissue cell or a cartilage cell, and a cartilage cell or a bone cell. It is for this reason that it is hard to assume that there is any specific cell in bone production.

UNDESCENDED TESTICLE—OMBRÉDANNE'S OPERATION

DR. ASTLEY P. C. ASHHURST presented two lads on whom he had operated, by Ombrédanne's method, for undescended testicle.

CASE I.—Was fifteen years of age. His right testicle lay in the inguinal canal visible as a small swelling. Operation June 29, 1927, at the Episcopal Hospital. After making the usual incision for inguinal hernia, and dissecting the testicle and cord free from the internal ring and inguinal canal, a second incision was made transversely into the left half of the scrotum, and the scrotal septum incised just enough to permit pulling the right testicle through into the left scrotum. The opening in the septum was closed snugly around the cord just above the testicle, and the scrotal incision closed; the inguinal canal was closed without transplanting the cord after excising the sac of the indirect inguinal hernia.

The patient now presents a well formed scrotum, both testicles lying loosely in its left half. The boy is unable to tell on palpation which of the two testicles is the right. The testicles lie more or less one above the other, and as the upper testicle is smaller, it is probable that this is the right testicle.

CASE II.—The second patient, aged seven years, had both testicles undescended: the right could be felt in the inguinal canal, but the left was not palpable; the scrotum was undeveloped. Operation October 12, 1927, at the Episcopal Hospital. Both inguinal canals were opened: on the right the epididymis was found at the external ring, with the testicle in the inguinal canal; on the left the testicle (smaller than normal) was adherent at the internal ring. There was a well formed hernial sac on the right but none on the left side. After dissecting both testicles and spermatic cords free from the inguinal canals and internal rings, a transverse incision was made across the front of the small scrotal pouch, exposing both sides of the septum separating the left from the right sides of the scrotum. This septum was then perforated, and the left testicle pulled through the perforation into the right side of the scrotum and the right testicle through the same perforation into the left side of the scrotum. The opening in the septum was then closed snugly, around the crossed spermatic cords; the incision in the scrotum was closed; and both inguinal canals repaired as in the first case, after excising the hernial sac on the right, and repairing the parietal peritoneum on the left where it had been opened to permit bringing the testicle down toward the scrotum.

The boy, who is otherwise well developed for his age, now presents both testicles normally mobile in a well developed scrotum. The left testicle (lying in the right scrotum) is still somewhat smaller to palpation than is the right.

DOCTOR ASHHURST added that this method of operation for undescended testicles was described by Ombrédanne in 1911, but it seemed to have attracted

little attention in this country. He was impelled to put these cases on record because of the report by Dr. K. P. A. Taylor at the December, 1927, meeting of the Academy of an operation done in two stages: the testicle first is sutured to the patient's thigh, to keep it from retracting into the inguinal canal; and is cut loose from the thigh only after some months. Doctor Ashhurst had found it difficult to keep the testicles well down in the scrotum after operations on cryptorchids, until he had adopted Ombrédanne's method, which has the advantage over that just mentioned (known by the name of Torek) of being completed in one stage, besides being just as efficient.

Dr. Dewitt Stetten, of New York, said that personally, he had had no experience with Ombrédanne's operation for undescended tecticle because he has always been quite well satisfied with the method described by Davison in *Surgery, Gynecology and Obstetrics*, in March, 1911. This consists in complete division of the posterior wall of the inguinal canal, including ligation and division of the deep epigastric vessels, thorough isolation and mobilization of the spermatic vessels and the vas, and a lowering of the entire cord by a reduction of the looping of the vessels and vas to their straightest and most direct course possible, a Ferguson hernioplasty, and then subsequent gentle elastic traction on the testicle in the scrotum by a rubber band. At the Lenox Hill Hospital a number of the surgeons, notably Doctors Torek, Eggers and H. W. Meyer, have been using the Torek two-stage operation, or as it is sometimes called, the Keetley-Torek operation, with exceptionally good results, as Doctor Meyer has reported in *Surgery, Gynecology and Obstetrics* in January, 1927. They had not been very enthusiastic over the Bevan operation, particularly since Moschcowitz showed experimentally that the vitality of the testicle was jeopardized by ligation of the spermatic vessels, and that, practically, atrophy of the testicle was not an infrequent sequel. Further, they had had at least one case at the Lenox Hill Hospital several years ago, in which there was a complete sloughing of the testicle following this operation. Two theoretical objections might be offered against the Ombrédanne method of transscrotal transplantation of the testicle through the septum to the opposite side of the scrotum, are: 1. In unilateral cases it tends to displace the normally situated testicle somewhat higher than it should be, and, 2. In bilateral cases it requires an operation on both testicles at the same time. This latter feature the speaker considers particularly objectionable as he believes that one testicle should be operated on at a time to see what the end result will be, particularly as regards the vitality of the gland, before the operation on the other side is attempted. If necrosis of the testicle occurred after the first operation, which is by no means impossible, then it would be inadvisable to risk operating on the other side—for, although it is generally conceded that the possibility of eventual spermatogenesis in even a reduced ectopic testicle is doubtful, it is also more or less agreed that such a testicle is not without value in influencing the sexual development of the individual through its internal secretion. If there is a lack of development of the scrotum, the Ombrédanne method is definitely contraindicated. This applies particularly to the bilateral cases. This lack of development of the scrotum

is especially well taken care of by the Torek operation. A serious practical objection that has been advanced against Ombrédanne's technic and that has led a number of surgeons to abandon it, has been that in cases in which the transscrotally transplanted testicle becomes necrotic, an infection may develop which may involve and threaten the normal testicle.

Dr. Franz Torek, of New York, said that these two cases show that the testicle which was brought out of its former place has remained in the scrotum; but the result in these two cases is not ideal. In the case of the larger boy, the transplanted testicle is at a position about midway between the position of the normal testicle and the pubis, too high up for an ideal position. In the case of the smaller boy, both testicles are very high up, close to the pubis and especially the right one which can scarcely be felt. It is probably a case of atrophy which no surgeon can control by any operation. The ideal result of operation is one which brings the testicle down into the bottom of a well-shaped scrotum. The speaker never practices the Ombrédanne operation. Looking at it from a clinical standpoint, as Doctor Stetten has pointed out, it has occurred that the transplanted testicle occasionally becomes gangrenous; that ought not to happen, but nevertheless it has occurred a number of times. If a testicle is transplanted, that will become gangrenous, into the opposite side—where there is a normal testicle—the risk is taken of also destroying the other testicle by infection, and this may be a theoretical objection to the operation. In the case of both testicles being undescended, as in the smaller boy, there is practically no scrotum, or very little, and the testicle cannot be expected to be well down in the scrotum, if there is no such receptacle to hold it. There is no better way of making a scrotum than by attaching the scrotum to the thigh, as in the Torek operation. The fact that the testicles are crossed can not form a better scrotum. The cases operated upon by the speaker's own method have been perfect operative successes. One cannot make a sterile person function again—although in one case the operation was done on a married man who eight years afterward became the father of a child, so that there is a possibility that the nutrition given by the attachment to the thigh may be of some value.

Dr. Frank S. Mathews, New York, said that it would be to the advantage of any surgeon interested in the general subject of testicular descent and the function of the scrotum to consult an article by Carl Moore in the first number of the *Quarterly Review of Biology*, called "Biology of the Mammalian Testis and Scrotum." The question of the migration of the testis into the scrotum in some animals and its retention in others has always seemed difficult to explain. Comparative anatomy does nothing to clear up the subject. Moore's paper, covering previous work and his own contributions to the subject, make interesting reading. It seems demonstrated that the scrotum is a heat-regulating mechanism, the absence of fat, abundance of sweat glands and the cremasteric reflex facilitating its functioning. Differences of temperature in the scrotum and abdomen have been recorded from one to five degrees centigrade. A thick covering has been applied to the

scrotum in animals and, on killing them a short time afterward, all the cells (except the Sertoli cells) lining the tubules are found disintegrated. Testes of adult animals transplanted under the skin of the abdomen always show disappearance of spermatic cells. If the transplantation has not too long continued, replacement in the scrotum will end in regeneration. Wagenstein in the March, 1927, *Archives of Surgery* has added something to the subject. He has shown that there is comparatively little growth in the testis from birth up to ten years. After this, when maturation has taken place, if the testis is either replaced in the abdomen or even under the skin of the abdominal wall, the degeneration which results cannot be recovered from by returning the testis to a normal scrotum. A Japanese transplanted both testes under the skin of the abdomen and constructed a cooling apparatus which he applied to one of the testes with the result that degeneration in the tubules was prevented on the side to which the cooling apparatus was applied. It would seem as though in transplanting the human testis into the thigh of the child by the Torek method, no great harm to the organ would be done but that if the same operation is performed after puberty, that spermatogenic function would be destroyed.

BURN SCARS OF CHIN AND NECK. TUBE-PEDICLE FLAP

Dr. Robert H. Ivy presented a man, aged thirty, referred by Dr. Calvin M. Smyth, Jr., September 8, 1927, with marked scarring and contractions of chin, lower lip and neck, resulting from burns when he fell into an open fireplace eight years before. He had already had about twenty-five operations. The chin was still bound to the chest by dense scars, obliterating the profile of the neck entirely, and causing some prolapse of the lower lip. He has been operated upon in several stages as follows:

September 16, 1927. Preparation of tubed pedicle on left side of back along inner border of scapula.

September 30, 1927. Flap raised on back at lower end of tubed pedicle and sutured in original bed for delayed transfer.

October 14, 1927. Excision of scar tissue beneath chin and flap from back swung by tubed pedicle over left shoulder and sutured into raw surface on front of neck.

November 4, 1927. Proximal end of tubed pedicle severed and swung around into chin and lower lip above flap on neck.

November 18, 1927. Loop between two ends of transferred tissue divided and sutured smoothly in place. By this means the contracture of the neck was abolished, the profile of chin restored, and the lower lip brought up into place. The flap from the back has proved very satisfactory in this and another case in furnishing the desired amount of tissue from a concealed part of the body. It was unnecessary to fix the head and chest by a plaster case during the transfer, but in a child on whom a similar operation was successfully performed plaster-of-Paris fixation had to be used.

BONE GRAFT OF LOWER JAW AFTER RESECTION FOR TUMOR

Dr. Robert H. Ivy presented a man, aged twenty-eight, who gives a history of having a large portion of the left side of the mandible resected by Dr. John B. Deaver at the age of eight for a tumor. When first seen he presented a healed defect of the left side of the lower jaw three inches in length. There remained on the left side a small portion of the ascending ramus.

The right side of the jaw and chin had been drawn over toward the left side with marked asymmetry of the face, and the remaining lower teeth were drawn inward and backward. It was possible by traction to pull the main segment of the mandible forward and to the right into fairly good relationship and fix it in position by means of metal splints fastening the upper and lower teeth together. These splints were made by Dr. E. F. Axt, of the University of Pennsylvania School of Dentistry, who specializes in this work. The small ramus fragment on the left side was left free without splinting. On December 9, 1927; nearly nine weeks ago, by an incision beneath the left side of the jaw, the ends of the mandibular fragments were exposed and freshened, and a gap three inches long found between them. A bone graft from the crest of the right ilium was placed in the defect, in good contact with each fragment, and fastened in place with fine brass wire sutures passed through holes drilled in the bone. The wound healed without trouble. At the end of twelve weeks the splints will be unlocked, and it is expected that union will have taken place. It will then be possible to insert artificial dentures to supply missing teeth, restoring function of mastication and also improving the appearance of the patient.

Of all sources of bone graft for defects of the mandible, the crest of the ilium has been most satisfactory in at least twenty-five cases.

Dr. George Semken, of New York, remarked upon plastics after removal of extensive cases of cancer of the mouth and chin and after severe burn cases. He believes the ideal method is to use a sliding flap because the blood supply is preserved and œdema avoided. Another advantage is that instead of having four sides of scar tissue there are only three and the fourth is for future growth. This is important in young patients, because in a child a square of scar tissue remains unchanged throughout life, and as the skin grows about it, it will cause the flap to raise and puff out. It is important to place these flaps behind the line of motion, so that they do not interfere with motion and will not produce a keloid growth. Doctor Semken has tried to systematize a procedure whereby with one operation, the case can be completed. This is not possible in such severe cases. Where possible in work of this kind, the grafts are taken from the skin of the anterior chest which is almost like that of the neck and face in character and will not grow hairs and on which large sebaceous follicles will not appear, and which is more nearly like what the patient has lost. If the arm can be raised to the head the pedicle is brought to the face and the blood supply remains intact; this is more difficult with a long pedicle, because the longer the pedicle the less liable it is that the blood will go through. It is desirable to have the flap placed behind the lines motion. Dental prostheses have proved of great assistance in securing better results in these cases.

Regarding the bone graft in the second case, the speaker has been impressed at the ease with which a transplanted bone graft will heal and functionate. It is not so difficult to produce fixation but to produce it where the bone has been destroyed.

GASTRIC ULCER—BALFOUR OPERATION

Dr. John H. Jopson presented three patients operated upon for gastric ulcer by the Balfour method, cautery excision of the ulcer and posterior

gastro-enterostomy. He also made brief reports of three other cases treated by the same operative technic. The present drift of surgical opinion is decided toward a partial gastrectomy in the treatment of gastric ulcer. He did not wish to be understood as advocating the Balfour method as a general substitute for partial gastrectomy. The problem was a different one from that of duodenal ulcer, and he believed that Philadelphia surgeons were, as a rule, satisfied with the conservative measures in the treatment of ulcer of the duodenum. His own limited experience coincided with that of surgeons like Moynihan and Balfour, who, working in large clinics with abundant material, observed satisfactory results following gastro-enterostomy for duodenal ulcer, with cures in 85 per cent. of their cases, and either with or without direct attack upon the ulcer itself. While subtotal gastrectomy has been advocated and extensively practiced in Europe for both gastric and duodenal ulcer, there is, as Balfour says, a wave of reaction against the sacrifice of large areas of a healthy organ as an indirect attack upon a benign lesion not situated in the stomach itself. This in spite of the fact that the mortality of partial gastrectomy is admittedly low in experienced hands.

With gastric ulcer the case is different. It must be remembered, as Moynihan has emphasized, that one is dealing with a much rarer lesion. The percentage of recurrences after conservative methods has been high. These include simple excision of the ulcer, a posterior gastro-enterostomy, and a combination of the two, using knife or cautery to remove the ulcer. Sleeve resection he would reject. A few undoubtedly recover after gastro-enterostomy alone; excision alone is probably less beneficial. A combination of the two, and use of the cautery for excision, is superior in its results to either alone. The cautery should not be used for puncture only in accessible ulcers, but should be used as a cautery knife to remove the ulcer and its inflamed edges as well. The greatest indication for its use as a substitute for gastrectomy which is the operation of election in the majority of cases, would seem to be in those ulcers on the posterior wall and lesser curvature close to the œsophagus, where gastrectomy would be difficult, and where oftentimes the portion of stomach remaining would be exceedingly small. In such cases the radical operation partakes of the nature of a total gastrectomy, and trial of less radical measures certainly seems justified. On the other hand, small accessible lesions, easily mobilized, are considered by Balfour himself as favorable instances for the same treatment, by excision and gastro-enterostomy. Doctor Jopson was familiar with the objections urged against conservative treatment by Lewisohn and others and with the mortality statistics in which the deaths ranged from 1½ per cent. to 7 per cent. after subtotal gastrectomy, but he thought that it would be a good deal higher in the hands of surgeons whose experience in this field was not as large.

Of the three cases shown, all males, one was well after one year, and one after two years. The latter was a bleeding case, was transfused before operation, and had a subacute perforation on the posterior wall. During convalescence, the abdominal wound reopened because of deficient healing power, due to the patient's poor condition pre-operative. It was successfully closed by the technic of Shipley of Baltimore. The third case, first operated upon four and one-half years ago, relapsed, and was again operated upon in October, 1927. The ulcer was then very large, greatly indurated, on the lesser curvature, and close to the œsophagus. Sections removed by the cautery showed it to be nonmalignant. It was sutured with difficulty, and an enterostomy established for post-operative feeding. He has done well since, after a course of treatment by the Sippy method, and at present is in fair health, without gastric symptoms, so long as he adheres to a simple diet.

Two other cases are well. One, a woman, had a cholecystectomy at the same time the stomach was operated upon. A sixth case, also a woman, reported as working most of the time and with some symptoms, controlled by diet. She also was a transfusion case, had a decided tendency to hour-glass contraction at the time of operation, and today would be treated by gastrectomy and not by the conservative operation, if her condition permitted.

Dr. Richard Lewisohn, of New York, said that his experience at Mt. Sinai Hospital, has gradually forced him to adopt more radical procedures after having tried all the conservative methods, because the conservative methods were not satisfactory. He did local excisions a great many years ago and got recurrences; he did them without gastro-enterostomy and with gastro-enterostomy and found that the results were equally bad. He then tried sleeve resections and did not obtain very good results either. A large percentage of cases got hour-glass formation of the stomach and came back with recurrence of symptoms. Thus he was forced to adopt partial or subtotal gastrectomy for gastric ulcers and has been highly pleased with the results.

Local excision does not change the acidity of the stomach, and the patient still has the same underlying cause. The cautery method is based on the assumption that an acute perforation causes a cure of the gastric or duodenal ulcer. The speaker's statistics on that point indicate that suture of an acute perforated gastric or duodenal ulcer with or without gastro-enterostomy fails to cure the patient in 39 per cent. of the cases; in other words nearly half of the patients were not cured and still had ulcer symptoms. Partial gastrectomy not only removes the ulcer, but the ulcer-bearing area with the accompanying gastritis and while the results from partial gastrectomy for duodenal ulcer have not been 100 per cent., Doctor Lewisohn is willing to state that in gastric ulcer they have been perfect. The procedure is not difficult if confined to those ulcers which are situated near the reëntrant angle; in the very high ulcers, at the cardia, it is wise to be conservative, because a total gastrectomy is certainly a very serious operation and not often attempted. Partial gastrectomy does not remove a normal organ, but a diseased organ and does something for the patient which no other method can do, *i.e.*, it establishes post-operative achlorhydria, which seems to be the best means to prevent the recurrence of the ulcer. Doctor Lewisohn demonstrated lantern slides of a very interesting case, illustrating the life cycle of an ulcer. This patient was explored in 1922 for a large gastric ulcer, located right at the cardia. It was thought that the ulcer was carcinomatous and inoperable and nothing was done. The slides show that between 1922 and 1925 the ulcer disappeared. X-ray pictures taken in February, 1927, show a recurrence of the ulcer. Röntgenograms taken six months later show no evidence of an ulcer. Had gastro-enterostomy been done on him or if he had been subjected to a Sippy diet, one would have thought that surgical or medical treatment effected the temporary cure.

Dr. A. O. Whipple, of New York, said that he had observed five patients in the Presbyterian Hospital in New York, who illustrate a point

which he thinks should be borne in mind, *i.e.*, too much credit should not be given to any one particular form of therapy for a lesion in which several forms of therapy give good results. In these five patients it was thought for one reason or another that it would be unwise to operate. They all showed definite penetrating ulcers in the lesser curvature; some were high and some were slightly lower. They were placed under treatment; in two cases very thorough medical treatment and in the other three cases very spasmodic treatment—and in all five cases the ulcers disappeared. Three of the cases later came to the post-mortem table—this does not mean that they died from the ulcers—one patient committed suicide because of financial losses, another died in a Sanitarium for the insane, and a third died of carcinoma of the bronchus. The other two patients have apparently remained symptom-free. In the three cases which came to post-mortem, one showed complete healing of the ulcer, nothing remained of the previous lesion; in another there was a definite defect in the mucosa which undoubtedly if it had been watched for some time might have showed what Doctor Lewisohn has shown.

FIG. 1.—Serial tracing of an ulcer of the lesser curvature, treated by rest in bed.

The speaker has not had a very wide experience with the Balfour method but has had some remarkably good results in five out of eight cases. One case which has been operated upon by the Balfour method without gastro-enterostomy is free from symptoms after six years; on the other hand, three out of the eight cases have not shown good results; two have been reoperated and subtotal gastrectomy performed. Two cases had previously had gastro-enterostomy. The speaker regards the operation as a valuable procedure in the cases which do not lend themselves to a subtotal gastrectomy after a thorough course of medical treatment. If an exploratory operation is done and removal is attempted, Doctor Whipple believes that subtotal gastrectomy gives a better result than the cautery method. If the ulcer is high or massive, the cautery method is an excellent procedure.

DR. FREDERICK BANCROFT, of New York, said that he had seen several cases diagnosed by Dr. L. G. Cole at the Fifth Avenue Hospital, where there has been

a large lesser curvature ulcer. Doctor Cole advises putting these patients in bed without any specific dietary treatment, and they are X-rayed every three days. It is interesting to note the way these ulcers repair. There is a gradual ingrowth from the edges of the ulcer, producing a type of constriction. (See Fig. 2.) After this constriction occurs, repair proceeds by diminishing the depth of the ulcer. From the study of these cases we have formed a precept that if there is no diminution in the size of the ulcer after three weeks' rest in bed it becomes surgical. In six out of seven cases so observed, healing is shown by the X-ray to have occurred within four weeks' time by rest in bed and medical treatment.

Fig. 2.—Serial tracings of an ulcer of the lesser curvature, treated by rest in bed.

Dr. John H. Gibbon recalled that two years ago before the joint meeting of these societies, he presented a man upon whom he had performed a gastro-jejunostomy some years before and who had had subsequent bleeding. At that time Doctor Gibbon thought that the patient had a jejunal ulcer. No jejunal ulcer was found, the old duodenal ulcer had apparently healed. Pylorectomy was done at the time. Doctor Lewisohn said that the patient would not be well, he thought, until a subtotal gastrectomy had been done. Today the patient is perfectly well. He had no medical treatment. With Doctor Whipple, the speaker agrees that it is a mistake to try to have one operation to cure many things. Subtotal gastrectomy is the best procedure in gastric ulcer but there are cases where smaller ulcers can best be excised by the cautery.

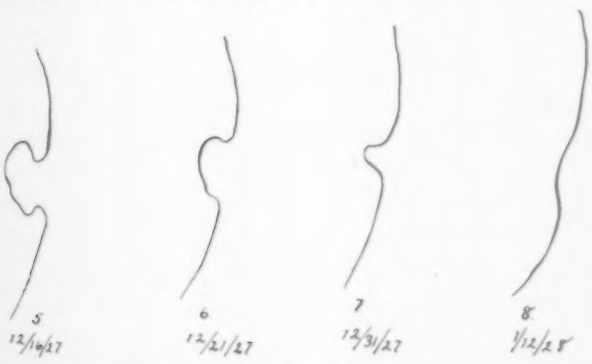

Fig. 3.—Serial tracings of an ulcer of the lesser curvature, treated by rest in bed.

Dr. John H. Jopson said that if these cases are so diseased, as Doctor Lewisohn says, it is remarkable that they can do so well without treatment of any sort. There were two more patients in this series, who were unable to be here; one a woman operated upon in 1926, and another, a man operated upon by this method who later returned with recurrence of symptoms; he

was given bicarbonate of soda and cascara and is at present symptom-free. One other patient had had an ulcer for fifteen years and now has hour-glass constriction of the stomach and should have a partial gastrectomy.

SURGERY OF THE PITUITARY LESION

Dr. Charles H. Frazier read a paper with the above title for which see p. 1.

CLEFT LIP AND CLEFT PALATE

Dr. Warren B. Davis gave a résumé of 425 cases which he has recently reported in detail for which see the Annals of Surgery, vol. lxxxvii, p. 386.

Dr. F. S. Mathews, of New York, said that the presentation of these cases showed the wisdom of having harelip and cleft palate cases operated on by specialists. The number of cases throughout the country is not sufficient to give all surgeons an adequate training and it is much better that one or two surgeons in each city should give special attention to the subject. The bearing of heredity in the etiology has received much confirmation. Davenport, in his "Heredity and Eugenics" illustrates this with a number of family trees. That the cause is inherited, is practically demonstrated by a number of cases where identical twins have shown the same defect. Ritchie and Davis have advised a change of nomenclature which involves abandoning the old name of harelip. It is in the interest if clearness of description to speak of cleft lip, cleft alveolus and cleft palate, qualifying these terms by the adjectives complete or incomplete and unilateral or bilateral. The cleft in the alveolus is the matter of first importance and where the alveolus is cleft, it makes it advisable to close the lip, not because of the importance of the lip in itself, but because the closure of the lip aids so much in moulding the alveolus and in closing or narrowing the entire length of the palate cleft. Doctor Mathews has used a wire suture in the alveolus to narrow the cleft there as much as possible, closing the lip at the same time to increase the effect of the alveolar suture. Following Moorehead, of Chicago, he has spent ten or fifteen minutes in digitalar manipulation of the alveolus immediately preceding the operation in very young infants. He has several times operated on the lip and alveolus in children only two days old. When they are two or three weeks old, they have usually lost more weight than normal children. In former years when he saw one of these children underweight and with subnormal temperature, it was his custom to send them to the pediatric division of the hospital to improve their nutrition before operation. This never worked. They always ran down and they often died with intercurrent affections. Now he sends them home with the advice to build up their general condition and then bring them back to the hospital. He was glad not to hear any recommendation of Brophy or Lane methods. He thinks they have had their day. He believed the point emphasized by Brophy that these clefts are not associated by any deficiency of tissue is incorrect. In some cases, he thinks the lack is considerable. This is rather conspicuous in cases of bilateral cleft lip. When all the tissue available in the palate is used, we often have a

thin palate and one far too short to close off the pharynx. Lane's method has been abandoned pretty generally because of poor speech results. The thing to be kept prominently in mind in treating these cases is to so reconstruct the alveolus that chewing and nasal breathing will be possible and thus by establishing function, favor normal growth.

Dr. Fenwick Beekman, of New York, said that on the service of Dr. Carl Burdick, at Bellevue Hospital, they have gone through the many stages of operative procedures on harelips and cleft palates and have finally come to the conclusion that the type of operation which they now do and which is similar to that described by Doctor Davis, is the one which gives the best result. Without any doubt the time to operate is when the child is young for at this time of life the alveolus can be moulded. The alveolus in those individuals with single clefts usually has the normal curve in the side of the cleft. The other side has a curve which is less acute than normal and consequently the end of the cleft on this side of the alveolus is far in front of that of the other. This can be corrected by moulding it to the proper curve.

Brophy's operation by narrowing the palate did not overcome this deformity. For several years the speaker has been moulding the alveolus and holding it in place by passing a silver wire far back above the alveolus and around through the frenum of the lip, thereby holding the moulded alveolus in place. The lip is immediately repaired. The wire is removed in twenty days. The importance of early operation, that is at the time when the alveolus can be moulded, was demonstrated recently by a child with a large cleft in his alveolus, five years of age. In this case the alveolus could not be moulded and had to be fractured, wiring the fragments in to proper position. We have had the same experience as Doctor Mathews has had. A large number of the infants sent to the pediatric service having died from pneumonia.

Dr. George M. Dorrance said that he had had over 1000 reports abstracted and had gone over each and every one of them; all the operations in question are described three to five times. In the particular operation which Doctor Davis describes, the first part is after the method of Dieffenbach, and the second part after the method of Buhl. Many authors make the statement that they have used a particular operation in the past but have given it up. Very few say why they have given it up, with the exception of Passabaum who definitely states that if the soft palate is not long enough to touch the posterior wall of the pharynx when sewed together, then the operation is a failure and it would have been better never to have touched the palate, but to let a dentist put in an appliance which would have given a better result than a faulty operation. Concerning these cases with a short palate, Doctor Dorrance had seen three cases in one day where the palate was normal but could not touch the posterior wall of the pharynx. In such cases the speaker frees the palate all the way around to the alveolar margin and cuts the tensor palati muscle, allowing the constrictor muscle to pull the palate back. This leaves a hole in the front part of the palate which can be closed with a plate. But these cases can speak.

Dr. Addinell Hewson said that from an anatomical viewpoint if the process is broken so as to allow the tensor palati muscle to act in a straight line, it will have a tendency to bring the soft palate back toward the pharyngeal wall. It does another thing by relieving the ligaments to which are attached the superior constrictor of the pharynx and the buccinator muscle. The pterygo-mandibular ligament being freed from the sphenoid allows the lateral wall of the pharynx to come forward. It also allows the tensor palati muscle to bring the soft palate back toward the pharyngeal wall. Under these circumstances it would appear that the outline Doctor Davis has given should help materially in bringing the palate and pharyngeal wall together.

Dr. Warren B. Davis said regarding the choice of time for operation, that it should be done as soon as the child's condition warrants, from ten days to three or four months. The speaker has been doing these operations since 1914, and certainly the best articulation is in those cases in which the operations on the lip, alveolus and palate were completed before the child was two years old.

COMPLETE URINARY RETENTION IN A CHILD, NECESSITATING CYSTOTOMY, EXCISION OF VESICAL ORIFICE OBSTRUCTION, NEPHROURETERECTOMY AND RESECTION OF BLADDER

Fig. 1.—Urogram displaying large hydronephrosis and hydroureter, also dilated bladder.

Dr. B. A. Thomas reported the case of a male child, aged two years and ten months, who was admitted to the service of Dr. Charles A. Fife at the Presbyterian Hospital, October 13, 1927, and transferred to the genito-urinary service four days later. The case demonstrates extensive pathology, which is not infrequently found in children with urological lesions, the importance and feasibility of a complete urological investigation, and the successful result following rather extensive surgical intervention. During the past three months two other cases of complete retention of urine in infants had come under the speaker's care, one a two and a half weeks old female at the Babies' Hospital, in which the retention was the result of pressure from a

greatly distended vagina, due to an imperforate hymen; the other a male six hours old requiring external urethrotomy, at the Graduate Hospital of the University, for a congenital stricture or impassable obstruction of the urethra.

The case under report was brought to the out-patient department of the hospital because of inability to urinate. The previous medical history was negative; the birth being a twelve-hour non-instrumental labor first pregnancy at full term. The family and social histories were also negative.

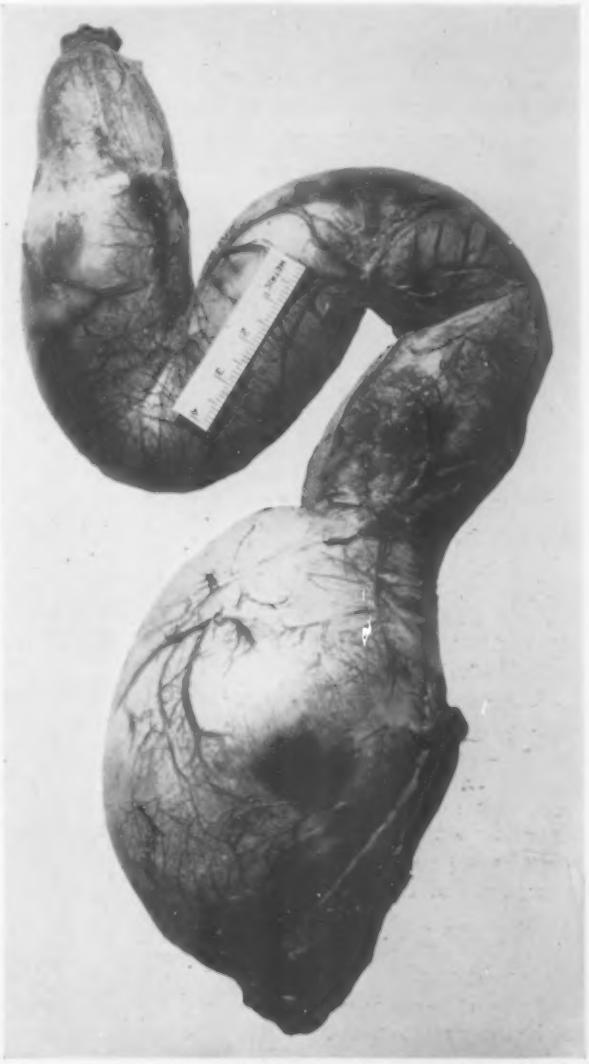

FIG. 2.—Hydronephrotic deformed kidney and hydroureter removed at second operation.

For two weeks prior to admission the child had some frequency of urination, associated with constipation, requiring milk of magnesia to insure a bowel movement. A week later the urinary difficulty became marked and the child passed no urine at all for two days previous to admission. Stools were possible only with enemata. There had been no vomiting, but appetite had been poor for a week or two, and the child was languid. A slight fever had existed for five days. The child had not complained of pain, but stooped over when he had a desire to urinate. He had lost some weight and on admission weighed not quite twenty-nine pounds.

On admission temperature was 101 1/5° F.; pulse, 128; respirations, 36. The child although well nourished and developed had a strained expression on his face. He constantly bent his trunk and held his lower abdomen, as though he were in great discomfort. The head, ears, nose, eyes and mouth were negative, except for pallor of skin, mucous membranes and hypertrophied tonsils. There was slight adenopathy of postcervical lymph-nodes. Lungs and heart were normal. Abdomen was distended and tympanitic and bladder dulness extended upward to umbilicus. No masses or enlarged organs were palpable. Peristalsis was present. Extremities and reflexes were normal.

Urination was impossible without catheterization, and that was successful

only with a metal catheter, evacuating a cloudy urine, loaded with pus and bacteria; otherwise negative.

Bacteriological examination revealed staphylococcus aureus in pure culture at first, later mixed with the colon bacillus. Tubercle bacilli negative. Blood count: Reds 3,710,000; whites 10,250; hæmoglobin 70 per cent.; small lymphocytes 24; large lymphocytes 7; polymorphonuclears 63; basophils 1; transitionals 1; eosinophils 4. Wassermann, negative. Blood urea nitrogen 17 mgms. per 100 c.c.

Chromoureteroscopy and ureteral catheterization were done October 19. The bladder mucosa was found to be greatly inflamed, œdematous, very red and covered with flakes of inflammatory exudate. In the region of the right ureteral orifice there was a large opening very suggestive of a diverticulum, but later determined to be the opening of a greatly dilated ureter. Indigocarmin, intravenously, appeared from the left normal ureter in twelve minutes; none appeared from the large opening on the right side. Both sides were catheterized: the urine from the left side was normal and sterile, that from the right contained thirty-five to forty pus cells to the field and culturally demonstrated the colon bacillus and staphylococcus aureus. The most conspicuous abnormal condition in the bladder was a marked protrusion of the whole vesical mucosa on the right side below the large ureteral orifice, the same infringing on the bladder outlet, which presented a bar or lipping at the trigonal apex.

FIG. 3.—Stump on lower end of ureter removed at third operation.

Urography was done two days later displaying the remarkable pyelo-uretero-cystogram shown in Fig. 1, defining a hydronephrotic kidney, a greatly dilated and kinked ureter and a much over-stretched bladder.

For ten days the child had not voided a drop normally, catheterizations were intolerable and had become a battle royal daily, urinary fever was becoming worse and the child more toxic. October 26 suprapubic cystotomy was performed and the bar or tissue obstruction at the neck of the bladder was removed by punch. The protruding or elevated floor of the bladder, in which the enlarged right ureteral orifice was situated, was definitely determined to encroach upon the vesical outlet. The usual pathology of a ureterocele could not be determined; it seemed that the whole mucosa of the right side of the trigone was flabby and greatly redundant and moved down upon the bladder sphincter, causing obstruction of the outlet. The rectum was found to contain about a handful of very hard feces (enteroliths). These were removed and the operation concluded.

The child made a very satisfactory recovery, picked up greatly in weight and strength and two weeks later, November 9, a nephro-ureterectomy was performed. (See Fig. 2.)

The gross specimen as described by Dr. John Eiman is as follows: "Specimen consists of a kidney and ureter. The pelvis of the kidney and the ureter are tremendously distended. The diameter of the ureter varies from 3.8 to 4 cm. It is kinked on itself so that it has assumed a sigmoid shape. The walls are a fraction of a millimeter thick. The pelvis of the

kidney measures roughly 9 x 6.3 x 6 cm. The wall is paper thin. The kidney measures 7.8 x 2 x 3.8 cm. Some fat is adherent to the capsule. The kidney is smooth and glistening and purplish-red in color. Over the distended ureter and pelvis is seen a network of large and small purplish veins. The kidney, pelvis and ureter measure 19 x 10.5 x 6 cm. in their greatest dimensions. Contents of ureter and distended pelvis, clear straw colored urine. Specimen preserved intact.

During the operation the child's pulse most of the time was uncountable, and following the operation his temperature reached 105, but again he made a very satisfactory recovery. He was given all the time necessary to regain his health and strength before his next operation. During this time his bladder

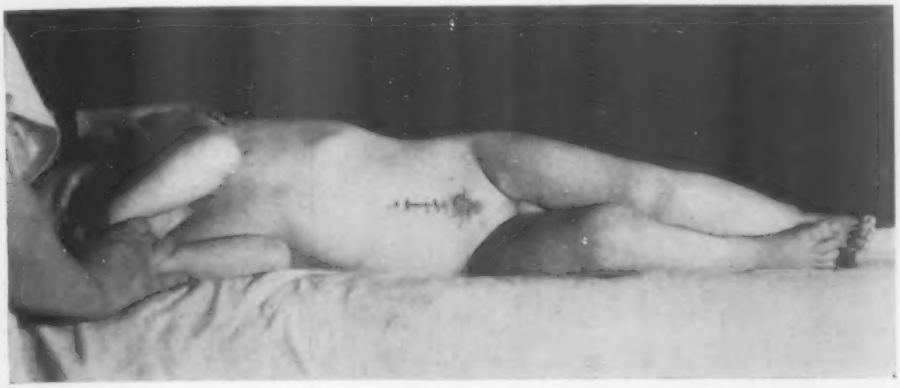

FIG. 4.—Ventral incision closed three weeks after final operation.

was drained suprapubically by a catheter, realizing that if the urine was not deviated in this manner, he would probably be unable to void because of the existing vesical pathology. However on December 21, his final and most serious operation, mainly removal of the lower end of the greatly dilated ureter with resection of the bladder, was performed as follows: As in the preceding operations, the anæsthetic was ether. The scar of the former suprapubic cystotomy was excised. The bladder was dissected free from the scar tissue of the former wound and mobilized, and the fistula enlarged. The right ureteral orifice about the size of the little finger tip was seen to be surrounded by redundant and very relaxed bladder wall, permitting bulging in the direction of the vesical outlet, which was obstructed, not allowing of the introduction of the tip of the little finger, and seemed to present a fibrous bar at the trigonal apex. This was removed with the punch. Marked granulations on either side of the vesical orifice were removed with the electrocautery. After packing the ureteral stump and bladder with gauze, they were freely mobilized. The bladder was then incised posteriorly and the ureteral stump removed by block resection of the adjacent portion of the bladder through all its coats. The posterior incision was closed by a Connell suture. The anterior incision by a running over and over suture about a large rubber tube. Another rubber tube, inserted on the right side of the bladder drained the resected area. The abdominal wound was closed in layers. The ureteral stump is shown in Fig. 3. Although the child's pulse was countless most of the time during the operation and his temperature reached 105 3/5° afterward, he nevertheless passed through a most satisfactory convalescence. Three weeks later the child began to void naturally. January 21, the suprapubic wound closed permanently and sounds Nos. 10, 12 and 14 F. passed

easily through the urethra into the bladder. The child's condition today as shown by photographs (Figs. 4 and 5), and weight curve (Fig. 6), is normal, except for a few pus cells in his urine and he is about to leave the hospital.

Comment.—There is no evidence to prove that this is a case of true ureterocele, caused by prolapse of the ureteral mucosa or of the entire lower end of the ureter into the bladder. Indeed, if so, it is certainly very atypical. In fact, congenital insufficiency of the ureteral orifice or regurgitant ureter, associated with an anomalous condition of the trigone and obstruction of the vesical orifice, could explain the pathology better. The thought of extensive congenital malformation is further borne out by the deformed remnant of renal tissue surmounting the hydronephrotic sac.

FIG. 5.—Lumbar incision prior to discharge from hospital.

DR. H. BEEKMAN DELATOUR, of New York, said that this is a rare and unusual condition which he had never seen before. This case shows the importance of not being satisfied that one pathologic condition covers the entire case. Had Doctor Thomas simply removed the ureter and kidney and made no further attempt at investigation, the patient would probably have dragged along for a time without the suprapubic wound healing and probably if at a later date the subsequent operation had been performed, the removal of the obstruction to the ureter would not have been so easily or so successfully carried out.

DR. EDWIN BEER, of New York, remarked that many of these cases of children with obstruction to the outflow of urine due to disturbances at the neck of the bladder are not recognized until examination discloses a large globular mass in the hypogastrium associated with residual urine. If undetected, these cases pass gradually into uremia, and are then thought to be cases of chronic nephritis. If infection complicates the picture, many of these cases are diagnosed as cystopyelitis.

In the case presented Doctor Thomas states there was pyuria and twenty ounces of residual urine, which can only be explained by an obstruction somewhere between the bladder and the external urinary meatus. Most of these cases occur in males. Usually the back pressure leads to a bilateral hydro-

ureteronephrosis, and cystograms which show the reflux up both ureters are diagnostic of the condition when it is well advanced. Cystoscopy is particularly valuable in these children, and is always indicated in cases of persistent pyuria in infancy. About five years ago, three of these cases were reported by Doctor Beer in which excision of the posterior lip of the neck of the bladder, where the obstruction to the outflow of urine happened to be, led to complete relief of symptoms and cure of the patient.

In connection with some of these cases of unilateral megalo-ureter and hydronephrosis the question arises, is this due to back pressure, as in the case

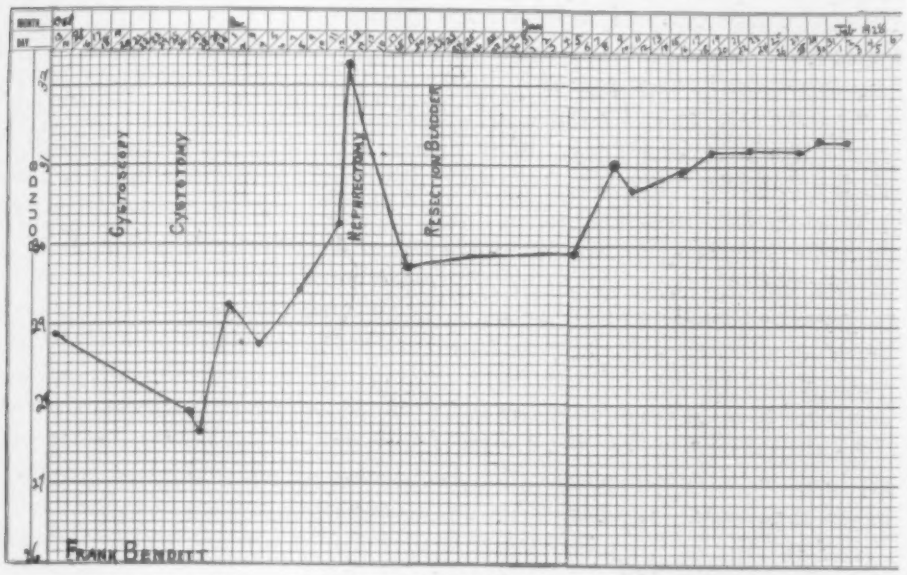

FIG. 6.—Weight curve from time of admission until discharged from hospital.

reported, or is it caused by a congenital disturbance in the anatomical development of the ureter and its orifice in the bladder. Some of these cases present in adult life, and it is difficult to decide the origin of the megalo-ureter. It must be borne in mind that it is just possible that in some of these instances a ureteral stone, blocking the lower end of the ureter in infancy (as has been seen by Doctor Beer in the first three months of a baby's existence), may lead to a hydronephrosis; and when the stone is passed later on, this permanent megalo-ureter remains, and is only recognized in adult life when an operation is done for infection of this dilated tube. One is then liable to think he is dealing with a congenital deformity, while the condition is really a disease which originated in the early months or years of the patient's life through such a process as just outlined.

GASTROSTOMY IN CARCINOMA OF THE ŒSOPHAGUS

DR. GEORGE P. MULLER read a paper with the above title for which see p. 48.

DR. WILLY MEYER, of New York, recalled a patient with malignant stricture of the œsophagus, who, after gastrostomy and forced feeding,

gained five pounds in one week. The type of operation he believes immaterial; though if Witzel's or Kader's method can be carried out, they will probably show best results. Gastrostomy is clearly indicated in these cases so long as radiologists cannot definitely prove that treatment by radium has brought about recovery. Here and there in various parts of the world there have been reports of cures by radium treatment; but definite proofs of œsophageal carcinoma having been cured by rays are still lacking.

The speaker thought that with thoracic surgery in its present status, surgeons should remain aggressive. What these patients need and are craving for, is the restoration of their power of swallowing. The principal aim of the surgeon should be the restoration of the patient's power to swallow. As long as radium has not proved definitely that, with the help of gastrostomy, it can cure, the radical operation remains indicated. Early diagnosis and early operation, of course are of greatest importance. The agencies which can help both the surgeon and the patient in this direction are the American Association for the Control of Cancer and the Gorgas Memorial. They are allowed to advertise in the newspapers and to distribute pamphlets. If they would say to these patients; "If you cannot swallow properly, your case is dangerous. Do not go to a dispensary, but go immediately to a hospital where X-ray examination and proper treatment are available," doubtless such propaganda would result in the patient's coming earlier under the care of the surgeon. It is the younger generation who will see a larger number of these cases at an earlier stage, and Doctor Meyer hopes that Doctor Muller will continue to do the radical operation in the hope of doing something definite for these patients. Three cases are on record that have lived after the radical operation. Doctor Torek's well-known case died of pneumonia eleven years after the operation.

Technically, the operation is not particularly difficult if one gets these patients in time. But when they come too late and when the important surrounding structures of the œsophagus are involved, one hesitates to do radical work.

It is in the hands of the surgeons now coming up, to see that resection of the œsophagus is not scrapped, but is continued. The speaker is convinced that if air-tight drainage of the pleural cavity is added to the operation, the number of recoveries will be greater than heretofore. On early diagnosis and early radical operation depends the future of the proper treatment of cancer of the œsophagus.

Dr. Franz Torek, of New York, said that gastrostomy in carcinoma of the œsophagus may be done either as a preliminary to a subsequent operation or as an operation *per se*. As a preliminary to the radical removal of the carcinoma, of course its field is limited to the very early cases, and Doctor Meyer has gone into that so thoroughly that it needs no repetition. In regard to gastrostomy as an operation *per se*, it is a very unsatisfactory operation. The patients all die, some early and some late. Those who die late are the ones in whom the carcinoma of the œsophagus has not broken down and is

more of a fibrous kind, while those who die early are usually the ones in whom the carcinoma has broken down, giving rise to bloody and foul discharge which practically poisons the patient. Regarding statistics, the speaker feels that if a person reports a number of cases that have lived for a long time after bouginage, you may be certain that it is in a series from an œsophagoscopic clinic, where a greater number of early cases are seen; whereas in many cases seen by the surgeon it would not be possible to pass a bougie at all. Such far advanced cases naturally are going to be operated upon by gastrostomy and will not live as long as the cases seen early in which bouginage is feasible. Theoretically, bouginage is about the worst thing possible for carcinoma of the œsophagus because instead of leaving it alone, the new growth is injured by being stretched and is thereby stimulated to more rapid development. Gastrostomy as an operation *per se* is done only in order to feed the patient and save him from starvation. No matter what the final result, gastrostomy relieves the patient for some time.

Dr. Howard Lilienthal, of New York, said that because he is the only person who has successfully resected the thoracic œsophagus without performing gastrostomy he is qualified for this discussion. The speaker drew attention to the method of relief by œsophagogastrostomy in cases in which exploratory operation has revealed inoperability, in carcinoma of the lower third of the œsophagus. The method was first published in Doctor Lilienthal's book called *Thoracic Surgery*—Saunders, 1925, volume 1, pages 361 to 370 and has since been described evidently independently by Sauerbruch in his second volume also published in 1925.

The procedure may be carried out extrapleurally by posterior mediastinotomy or intrapleurally. The fundus of the stomach is drawn upward through an incision in the diaphragm and a stoma is made between it and the upper section of the divided œsophagus, inverting the lower segment and leaving the inoperable carcinoma untouched. The speaker has performed this operation in but one case, unfortunately dead of pneumonia on the sixth day, but during those six days the patient was able to swallow normally soft solids without any leakage as was demonstrated at post-mortem examination. Those who are interested should look up the technic which is not difficult. The procedure is on the same physiological lines as gastro-enterostomy or ileocolostomy, performed in order to make a by-pass around an obstruction. If the pleura has been opened the phrenic nerve should be divided on the pericardium. If the pleura has not been violated the phrenic nerve should be avulsed through an incision in the neck.

MORTALITY FACTORS IN ACUTE APPENDICITIS

Dr. Eldridge L. Eliason read a paper with the above title for which see p. 65.

Dr. Morris K. Smith, of New York, said that in 337 cases of acute appendicitis operatively treated, there was a mortality of 4 per cent., thirteen deaths.

In reviewing these fatalities one is struck by the paramount necessity, now pretty well understood even by the laity, of early operation, if deaths are to be prevented. Abcess formation in appendicitis denotes an appreciable delay in bringing the patient to operation. In the seventy-seven cases in this series in which abscess was present the mortality was 10 per cent. as opposed to 1.9 per cent. in the remaining 260. Of the five individuals who died in the non-abscess group the duration of illness was given as one day, two days, four days, five days and two to three weeks respectively. The latter possibly should not be included. She presented an unusual type of thickened inflammatory reaction in appendix, cæcum and pelvis without free pus. Both of the apparently early cases, listed as of one and two days' duration were watched overnight before operation was undertaken. Perforation, gangrene or spreading peritonitis were found in all five. Early institution of operative treatment depends on early diagnosis. Doctor Eliason has brought out some of its difficulties. The speaker believes it is better practice to take out an occasional normal appendix than to err on the side of procrastination in so treacherous a condition as appendicitis. Age is a factor in a higher mortality of the disease for one reason because of the added difficulties in diagnosis. Of the thirteen deaths, two occurred at the extremes of life. One was a child of three years who had been sick a week before her mother called a physician. She had an abscess filling the pelvis. The other was a woman of eighty with abscess who succumbed after a long illness.

If all patients could be operated upon within the first twenty-four hours of the attack, the mortality would be very low but the factor of high virulence of the infecting organism or lack of resistance on the part of the patient would still account for a few fatalities. A young man operated on the second day of his illness presented a perforated appendix and generalized peritonitis with no walling-off adhesions. He was dead two days later. Although earlier diagnosis and operation might have changed the outcome yet the whole impression was one of an irresistible, rapidly progressing infection. A severe diabetic, who had at operation a retrocæcal abscess, developed a gas gangrene to which he rapidly succumbed. This is the only such complication in the speaker's series. Drainage, with little or no suturing, might have given a better result.

The factor of surgical judgment remains to be considered. It is trite to say that with a very sick patient the least possible should be done yet one is inclined to err in this regard. A girl with a large appendiceal abscess came to operation on the sixth day of her illness. She appeared toxic. The appendix was removed. She died twenty-four hours later. It is quite probable that had we been satisfied to drain alone the outcome would have been the same, yet it was poor judgment in this instance to subject the patient to the added trauma of the appendectomy. Doctor Smith's experience with enterostomy is slight, suffice to say that the one time when it was used the result was discouraging.

CLOSURE OF THE PROSTATIC BED IN SUPRA-PUBIC PROSTATECTOMY

Dr. John B. Deaver read a paper with the above title for which see p. 118.

Dr. John E. Jennings, of New York, said that there is no doubt that certain cases demanding prostatectomy can be operated upon early and can be done under spinal anæsthesia. When the preparation of the case has been very careful, spinal anæsthesia is a help. There are however some cases in which the heart will not stand any form of spinal anæsthesia; also, there are other cases which demand the two-stage procedure. With all due respect to Doctor Deaver, the speaker wished to say that supra-pubic prostatectomy, as shown by his cuts, makes him wonder if Doctor Deaver has not been deceived by the "tactus eruditus" in believing that it is the open air work which he has described. As to the preparation of these cases much has been learned from careful study of the blood chlorides, and Doctor Jennings believes the restoration of normal chlorides is an important factor.

Dr. Edwin Beer, of New York, stated that he could see no particular advantage in attempting to close the prostatic bed by suture of the mucous membrane of the bladder into the prostatic bed; if plain catgut were used, all these wounds being infected it would be absorbed long before adequate union between the suture surfaces could take place; and if chromic catgut were used, it might lead to calculus formation, and possibly in either case to stricture at the neck of the bladder. Attempts have been made by Doctor Beer to close the prostatic bed in this way, but as this is only feasible in a one-stage operation and had apparently no particular advantage except as a hæmostatic aid, he had given up this technical refinement.

Doctor Beer asked Doctor Deaver whether he had ever seen the result of such a suture at autopsy, and whether at that time or at subsequent reëxamination by urethroscopy there was any evidence that the suture had held, or there was any difference in the appearance of the posterior urethra from that of unsutured cases.

POST-OPERATIVE PULMONARY ATELECTASIS

Drs. Walter Estell Lee, Gabriel Tucker and Louis Clerf read a paper on the above subject for which see p. 6.

Doctor Isadore S. Ravdin read a paper entitled *The Production of Atelectasis*—based upon experimental work in which Drs. Walter Estell Lee, Gabriel Tucker and E. P. Pendergrass participated, for which see p. 15.

Dr. Howard Lilienthal, of New York, said that the term massive atelectasis may be employed as a compromise. Atelectasis does not mean airlessness but signifies, etymologically, absence of terminal expansion. True atelectasis can be produced only if the chest is open or if there is something within the thorax which compresses the lung such as fluid, gas under tension or other direct pressure upon the lung.

When something causes the lung to contract in the *closed* chest the same force which produces the contraction causes a filling of the air vesicles by a

kind of suction, with fluid and cells different from the exudation of pneumonia and with greater opacity to X-rays. This has been a convincing demonstration of the phenomenon known as atelectasis by obstruction of a bronchus and how the removal of this obstruction can produce a return to the normal. The atelectasis or collapse just referred to, however, seems to be due to an actual contraction of the lung. It is probably produced by some nerve influence.

In two cases recently reported by Bergamini and Shepard (ANNALS OF SURGERY, vol. lxxxvi, No. 1) the patients died of acute massive atelectasis and early autopsies were performed. One of these patients died on the table during the suturing of the wound in an abdominal operation. There was not time for a bronchial obstruction to have brought about the absorption of alveolar air and no obstruction was found post-mortem. Yet the pulmonary tissue on both sides with the exception of the extreme apices was solid like liver. The autopsy was performed by Doctor Symmers, at Bellevue. The diaphragm had risen as high as the fourth rib posteriorly evidently drawn up by spastic collapse of the lung with consequent increase of negative pressure.

In 1919, there appeared in the *Journal of the American Medical Association* an article which was prepared by Doctor Lilienthal for the Surgeon General of the Army, on Thoracic Injuries. It is a report of the Activities of Operating Team 39 in Evacuation Hospital No. 8. In addition to the speaker the members of the team were Dr. Walter M. Brickner and Dr. W. A. Kellogg of New York. This report states: "Atelectasis has been frequently noted by operators and we have never reached a satisfactory explanation of it. It usually occurs in the neighborhood of the wound and is something more than collapse of the lung. It is usually unilobular, the lung being contracted to a very small size, no air being in it at all. The tissues are soft and not infiltrated. We would suggest that animal experiments be carried out. . . ."

An interesting case from the clinical standpoint was that of a young man operated upon for appendicitis by Dr. Paul Livingston of East Orange, New Jersey. On the third post-operative day there was a sudden attack of coughing, bloody thick mucoid expectoration and fever which was diagnosed as a right lobar pneumonia. When seen by the speaker the physical signs suggested massive collapse and a röntgenogram revealed the classic picture, the heart being drawn entirely into the right side so that the lateral processes of the vertebræ could be seen. Two days later the lungs were clear. This was probably a case of obstructive atelectasis.

The speaker believes that in a case of post-operative atelectasis, in which the symptoms are severe and threatening, early bronchoscopy should be performed in the hope that there might be a mucus plug which could be dislodged. Pol Coryllos and Birnbaum (*Archives of Surgery*, vol. xvi, No. 2) in a painstaking and scientific paper presented 112 cases of massive atelectasis gathered from many sources and they believe that the only cause of this condition is obstruction. Judging by his own experience and that of observers

like Bergamini and Shepard with their convincing post-mortem material, Doctor Lilienthal must disagree with this conclusion.

He suggested that in the nomenclature of the conditions these three distinct varieties of atelectasis be made: 1, obstructive; 2, compressive; 3, essential.

TERATOMA OF THE MEDIASTINUM

Dr. John H. Gibbon presented a young colored man who had come to the Jefferson Hospital complaining of a swelling in the chest and shortness of breath. An X-ray diagnosis of mediastinal tumor with pleural effusion was made. The chest had been aspirated several times and Doctor Gibbon plans to operate upon the patient in the near future.

Dr. Carl Eggers, of New York, said that benign tumor of the mediastinum is so rare that no one man has sufficient experience to warrant entering into a free discussion of the subject. One has to study each case individually and work out a plan of procedure, just as Doctor Gibbon has done in this case. What the pathology of the condition in this patient is has not been established, and probably will not be until operation. The fact that fluid has been withdrawn on two occasions suggests the possibility of trying to do the operation in two stages. At the first session one might cut a window into the chest wall and get some idea of the nature and extent of the lesion. The tumor might be marsupialized. Gradual evacuation would avoid the serious reaction which might follow removal of such a large mass in one stage, even if it were feasible. At a later date extirpation could be carried out. In the literature one finds numerous cases successfully handled in that way.

BRIEF COMMUNICATIONS

SQUAMOUS-CELL EPITHELIOMA OF THE THYROID GLAND

CASE.—A married woman aged forty-seven came to the Mayo Clinic, December 14, 1927, because of goitre which she first noticed twenty-five years previously. For fifteen years there was little or no change in the size of her neck. During the last nine or ten years the goitre had grown gradually and during the seven weeks prior to her admission it had grown quite rapidly on the right side, causing pain in the right side of the neck which radiated upward to the right ear. For two weeks she had noticed definite redness over the growth. Her general health had been good until two months previously when her appetite failed. She had lost twelve pounds. The family history was unimportant; to her knowledge, there had not been any malignancy. Her mother had had a goitre but it was not the cause of her death.

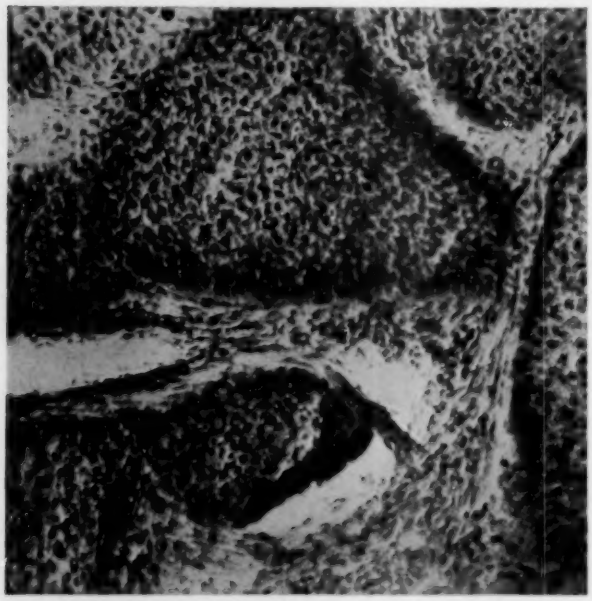

FIG. 1.—Squamous-cell epithelioma of the thyroid gland.

Examination.—The patient was rather obese, five feet five inches in height, and weighed 155 pounds. The eyes were normal. The tonsils were enlarged. The vocal cords moved normally. The diffuse enlargement of the thyroid gland (7.5 by 6 cm.) was nodular on the right side and extended into the posterior triangle. The skin over this area was quite red. The hæmoglobin was 68 per cent.; erythrocytes number 4,560,000 and the leukocytes 8,800. The systolic blood pressure was 124, the diastolic 84. Röntgenograms of the chest were negative. The metabolic rate was + 24.

A diagnosis of adenomatous (probably malignant) goitre with mild hyperthyroidism was made.

Operation.—December 19, under local anæsthesia, a small transverse incision was made about 2.5 cm. above the clavicle. The right side of the gland appeared grossly to be malignant. Part of it was removed and a tube left in place for the use of radium. Microscopic examination showed the tissue to be squamous-cell epithelioma (Fig. 1).

According to the literature squamous-cell epithelioma of the thyroid gland is rare. Roeder,* in 1921, made a complete review of the literature noting nine unquestionable cases. He gave an abstract of the cases and a complete

* Roeder, C. A.: Squamous-cell Epithelioma of the Thyroid. ANNALS OF SURGERY, 1921, vol. lxxiii, pp. 23–29.

bibliography. He also reported a case of his own, that of a woman aged sixty-two, who had had symptoms of substernal pressure for four months, accompanied by severe choking spells of two months duration. He removed the large adenomatous thyroid, the left lobe of which appeared malignant grossly. Microscopic examination showed squamous-cell epithelioma. Radium applications were made and the patient did well for fourteen days when she died following a paroxysm of coughing. Necropsy was not obtained.

CLAUDE F. DIXON, M.D.,
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FROM THE MAYO CLINIC

PULMONARY EMBOLISM

To the Editor, ANNALS OF SURGERY:

In the issue of the ANNALS OF SURGERY, April, 1928, Doctor Hall, on page 534, says:

"Trendelenburg has successfully operated upon pulmonary embolism in animals, but as yet there is no authentic case of successful removal in the human."

Before the German Surgical Congress of 1924, M. Kirschner presented a patient upon whom he had successfully operated for this otherwise lethal malady. This was the first successful case.

A. W. Meyer * presented at the 1927 meeting of the same society, a fine looking woman of fifty-four years, similarly rescued by him. Meyer adds useful additional details of technic.

* Archiv fuer Klinische Chirurgie, vol. cxlviii.

WELLER VANHOOK, M.D.,
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COMPLETE DOUBLE UTERUS WITH SINGLE VAGINA

DOUBLE uterus *per se* is not a very rare condition. However, only two cases like mine have been reported in the literature up until 1924 (see below).

Dambrin and Bernardbeig,[1] in 1924, made an elaborate report reviewing the literature of the various varieties of double uterus. They found only two cases in which there were two distinct uteri, two distinct cervices and only one vagina.

It will, therefore, be seen that this particular type of anomaly, in which each uterus was distinct and separated from each other on either side of the medial line, each with its own cervix but with a single common vagina, is very rare and as I have recently met with a case of this kind which is given below, I think it worthwhile to place it on record. In the recent literature I have found no exactly similar case. In Macgown's [2] case there were two uteri, two cervices and one vagina but this latter was divided by a fleshy septum with the clitoris and labiæ normal. In Moench's [3] case there were two uteri, two cervices and one vagina; but the two cervices were situated side by side and

united in the middle by a sagitally disposed fibrous band. In de Muylder's [4] case there was one vagina and two uteri, but the latter were probably in communication at the internal os as there was only one cervix.

The clinical and pathologic aspects of the various types of double uterus have been exhaustively dealt with in the reports by Palmer Findley and Dambrin and Bernardbeig already cited; also in a report by Guilleminet and Michon.[5] Palmer Findley [6] collected 132 cases of complete double uterus and reported three cases of his own. In all these cases there was a complete doubling of uterus, cervix and vagina and every patient had been pregnant. It would be superfluous to reiterate them and I will merely confine myself to reporting the facts of my own case.

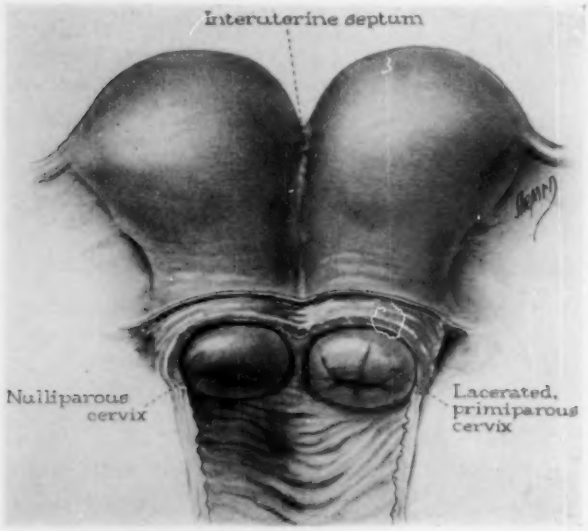

FIG. 1.—Appearance of uteri *in situ*.

CASE.—Mrs. L. S. (Case No. 33778), forty-one years old, female, white, housewife by occupation, was admitted to the American Hospital on November 3, 1927, and dismissed November 17, 1927.

History.—Menstruation began at fourteen, twenty-eight day type, flows four days without inconvenience. Patient has been married twenty-one years. No miscarriages. Has one daughter born nineteen years ago, living and well, full term child, weighed 6½ pounds at birth; no difficulties at delivery, normal labor. Following delivery she was told she had "falling of the womb", and she felt the uterus descending and protruding from the vagina.

Patient had usual diseases of childhood; much trouble with teeth and had influenza and pleurisy. She has always been a sufferer from chronic dysmenorrhœa. Patient notices, in the standing position, that the uterus comes out of the vagina about two inches. The prolapse is so marked during the menstrual period that the uterus becomes adherent to the menstrual pad. During menstruation she has bearing down pains from the sacrum to the lower abdomen.

Physical Examination.—Well-nourished female, not acutely ill. Temperature 98°, pulse 84 of strong quality and normal rhythm. Blood pressure, systolic 140, diastolic 94, respirations 20. Examination of head, neck and extremities negative. Examination of abdomen reveals a palpable spleen. The uterus is palpable through the abdominal wall as an irregularly outlined mass. Vaginal examination reveals the presence of two cervices (Fig. 1), one of which is somewhat larger and presents a stellate laceration. Both cervices present at the introitus vaginæ.

Operation.—Under ether narcosis, the abdomen was opened, by a median incision, and after packing the bowels out of the way, two distinct uteri presented. They were attached by a musculo-fibrous band at the uterocervical junction. Each uterus had one normally formed Fallopian tube and one ovary. Both fundi were of equal size and normal configuration. A supra-vaginal hysterectomy was done. After ablating the uteri two dis-

tinct cervical canals were visible. Plastic of the cervices. They were then treated in the usual manner, peritonealized and attached to the anterior abdominal wall.

The abdomen was closed without drainage. Patient made an uneventful recovery, leaving the hospital fourteen days after the operation. Wound healing per primam.

Pathological Report.—(Dr. J. J. Moore.)—The specimen is a double uterus, with both uteri opened exposing their endometrium—hardened in formalin—and amputated supracervically. Both uterine bodies are of about the same size, measuring 4 cm. long x 3 cm. wide, with average thickness of walls about 2 cm. They are attached to the upper part of the cervix. The endometrium in both uteri is apparently about 1 mm. thick and blood-stained. Each uterus has a Fallopian tube attached, the ovary being included with one of the tubes. This tube is about 8 cm. long x 0.5 cm. in diameter, and the attached ovary, which is fibrotic, measures 3 cm. x 1 cm. x 0.6 cm. The other tube is about 9 cm. long x 0.5 cm. in diameter. Neither tube shows any definite pathological change, grossly.

Microscopic Examination.—Sections show no essential differences in the endometrium and muscular wall of the two uteri.

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[1] Dambrin, C., and Bernardbeig, J.: Gynéc. et obstét. Par., 1924, vol. ix, pp. 292–308.
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[5] Guilleminet, M., and Michon, L.: Gynéc. et obstét., Par., 1924, vol. x, pp. 145–181.
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BOOK REVIEWS

GYNECOLOGY FOR STUDENTS AND PRACTITIONERS. By THOMAS WATTS EDEN and CUTHBERT LOCKYER. Third Edition. New York. The Macmillan Company, 1928.

This is the third edition of the well known English text-book of gynecology by Eden and Lockyer. This is a work with which the writer is exceedingly familiar through five years of acquaintance as the preferred text in gynecology at New York University and Bellevue Medical School. The retention of Eden and Lockyer as the text-book of choice through these years, speaks of the attitude of the gynecological department toward this work as no review can do. The present edition retains the high standard of its predecessors. It has been brought abreast of modern gynecological thought by the inclusion of such topics as recent researches in relation to menstruation and the corpus luteum and the work of Sampson as well as a presentation of the blood sedimentation test in relation to gynecology.

It is not the intention of the writer to offer a detailed review of this work for this would entail rewriting this edition or offering another. This text has maintained its position because of an excellent presentation of the ground facts in our specialty without which a superstructure is impossible. Gynecological anatomy and physiology are clearly and ably presented. Considerable space is given to such subjects as the follicle theory of menstruation and the influence of the corpus luteum. The entire text is replete with excellent illustrations. The number and clarity of the microscopical plates is unusual. Many of these are in colors.

As is true in all works there are many personal opinions of the authors with which the writer differs. This is most often noted in a consideration of therapeutics where differences may arise without affecting what we have called the ground facts in gynecology. In the section devoted to gynecological diagnosis considerable space is rightly given to tubal insufflation with both gas and opaque substances. We were surprised to find an absence of any reference to Rubin's work in America in this field. In considering hemorrhage and radiation the text is too brief and in several places misleading; for example in considering menorrhagia prior to the menopause a dose of 2400 milligram hours is advised with the suggestion that this be repeated in six weeks if necessary. This is a much larger dose than we are accustomed to, nor do we at all agree that radiation is suitable only for benign conditions and that radical operation should be applied in malignancy.

In the consideration of gonorrhœa in women we cannot follow with the authors in their endorsement of intra-uterine applications in corporeal infection nor in their apparent complete acceptance of diathermy in this field.

From an American standpoint we feel it an error to include in a text on

gynecology a consideration of such subjects as cystitis, pyelitis, acute appendicitis and diverticulitis. Is not this an unwarranted excursion into the fields of urology and general surgery?

The concluding portion of the text on operative gynecology is a valuable addition in which many of the more common operative procedures are well illustrated and described.

In conclusion the writer wishes to state that in his opinion this book occupies its present position because of its most able presentation of gynecological pathology. In many of our American texts there is an absence of this necessary foundation. Eden and Lockyer have ably correlated gynecological anatomy, physiology, and pathology presenting these ground factors, in our specialty, in a clear and concise manner with an abundance of microscopical as well as gross illustrations. The writer, for these reasons, considers this edition an excellent text-book for students, a good book for the occasional gynecologist to consult frequently, and a ready reference for the specialist.

FREDERICK C. HOLDEN

GYNECOLOGY. By HOWARD A. KELLY and Collaborators. Pp. 1012. D. Appleton Co., New York.

The author in chief has introduced into its text eighteen personal chapters representing those fields in which he has been so preëminently active and authoritative. The work bears no relation whatever to his earlier publication and has incorporated all of the late innovations in this science which have so greatly aided the specialist in the treatment of relevant conditions. Among these newer items are to be noted protein therapy, psychiatry and mental hygiene, ureteral stricture, endothermy, ultraviolet radiation, extra-uterine pregnancy, sterility, endocrinology and organotherapy.

In all, forty-nine chapters are found necessary to cover the subject. Both medical and surgical treatment are discussed in order to properly and exhaustively present the science of gynecology in all its ramifications by twenty-one collaborators, each particularly interested in the special field which he presents and whose preëminence in it particularly enhances the general value of the work.

The volume is adequately illustrated and the mere mention of the artists, Max Broedel, Horn, Becker, Freret, etc., is proof enough of their excellence of execution. The colored plates are particularly informative.

JAMES TAFT PILCHER

PHYSICAL DIAGNOSIS. By CHAS. PHILLIPS EMERSON, A.B., M.D., Professor of Medicine, Indiana University School of Medicine. Octavo, 553 pages, 324 illustrations. Philadelphia & London, J. B. Lippincott Co., 1928.

Diagnosis having become mechanized, attempts to standardize the same were but a natural sequence of the successive laboratory and instrumental

aids. Thus a more "Scientific Medicine" was being acclaimed at the expense of the "Art of Medicine" based on the observance of Signs and Symptoms of Physical Diagnosis.

The appearance of this volume of 553 pages and 324 wholly original illustrations is most welcome as harking back to those foundations upon which the Art of Medicine is built.

One was wont to regard a work on Physical Diagnosis as covering particularly the signs and symptoms of Lung and Heart. This treatise is vastly more comprehensive and replete in the narrative of physical signs peculiar to all exposed and hidden regions of the body wherefore it bids fair to be valuable alike to physician and surgeon, whose perusal thereof should greatly fortify one's failing sense of clinical medical and clinical surgical diagnosis, and heighten the appreciation of the medical student for time honored clinical teaching of physical methods which alone develop that prized attribute "Clinical Acumen," a *sine qua non* of the humblest practitioner of the Art of Medicine.

Physical Diagnosis of the abdomen is every bit as complete as that of the thorax, and this chapter is worthy of the attention of the surgeon as is the latter of the internist.

In short, recourse to the up-to-date methods of physical diagnosis are here rendered most admirably, and dependence on them must needs lead to good diagnoses. Each paragraph is initiated with heavy type and the salient features thereof likewise treated. The index of 20 pages printed in double column still further enhances the worth of this work.

MARTIN W. WARE.

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